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THE
UNIVERSITY OF ALBERTA

EDMONTON

CALENDAR 1915—1916

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ACADEMIC CALENDAR, 1915-16.

1915

May 1—Last day for receiving applications for June Matriculation, at the Department of Education.

June 21—Matriculation Examinations (Grade X and XI) begin.

August 14—Last day for receiving applications for examinations in Medicine, Dentistry, Law and Matriculation.

August 14—Last day for receiving applications for supplemental examinations.

September 1—Registration begins.

September 14—Autumn Matriculation Examinations.

September 14—Examinations of the College of Physicians and Surgeons of Alberta.

September 14—Examinations of the Alberta Dental Association.

September 14—All supplemental examinations.

September 29—Registrations close and lectures begin. (See page 55).

October 12—Meeting of the Board of Governors.

December 23—Christmas vacation begins.

1916.

January 4—Lectures begin.

January 15—Last day for submitting the investigation-topic for the Master's degree.

January 24—Examinations of the Alberta Land Surveyors' Association.

March 8—Ash Wednesday.

March 14—Meeting of the Board of Governors.

April 1—Last day for receiving applications for special matriculation examinations.

April 6—Lectures close in Applied Science and in the courses common to Arts and Applied Science.

April 10—Examinations in Applied Science begin.

April 19—Survey School begins.

April 19—Lectures end in Arts, Law and Medicine.

April 21—Good Friday.

April 25—Final examinations in Arts begin.

April 25—Examinations of the College of Physicians and Surgeons of Alberta.

April 25—Examinations in Law (Edmonton and Calgary).

April 25—Examinations of the Institute of Chartered Accountants of Alberta.

May 1—Examinations of the Alberta Dental Association.

May 1—Special Examinations of the Alberta Land Surveyors' Association.

May 1—Examinations of the Alberta Architects' Association.

May 9—Charter Day.

May 17—Convocation for the conferring of degrees.

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.....

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Organization of the University

HISTORY AND GOVERNMENT

The University of Alberta was created by an act of the Legislature of the Province passed at the first session after provincial autonomy had been granted (1906); that is, the act created the machinery by which the University could be brought into existence. By this act the University, which then consisted of the Chancellor, the Vice-Chancellor, the Senate, and the Convocation, was empowered to undertake the organization and development of the teaching faculties, to affiliate colleges, and, generally, to undertake all work relating to an institution of higher learning. An amendment to the act, passed during the session of the Legislature in 1907, authorized the Lieutenant-Governor-in-Council as a preliminary step to the organization of the University, to appoint the first President, to whom was to be given the responsibility, in conjunction with the Senate, of organizing and developing the university scheme. Acting upon this authority the Government selected the first President, who entered upon his duties on January 1st, 1908.

Under the act, all resident graduates of British and Canadian universities were entitled to become members of the convocation of the University of Alberta by registering before a fixed date. Three hundred and sixty-four graduates, representing all the Canadian and many of the British universities, registered, so that a large and representative body constituted the first convocation.

The act had also provided that the Senate should consist of fifteen members, ten to be appointed by the Government, five to be elected by the members of Convocation from among themselves. The Chancellor likewise was to be chosen by a ballot of Convocation . The voting for the first Senate election

closed on March 18th, 1908, and immediately thereafter the Government nominated its ten representatives. Mr. Justice Stuart of Calgary was chosen as first Chancellor.

As the Act made the Senate the governing body of the University, both in relation to education and business management, at the first meeting of that body, on March 30th, 1908, it took all the necessary steps to organize the first faculty, to be known as the Faculty of Arts and Sciences, and to open the University of Alberta for classes in this Faculty in September, 1908.

At the second meeting of the Senate, held in Calgary, July 6th, 1908, the first faculty appointments were made, four professors being named to co-operate with the President in the work of commencing instruction.

The first session of the University opened on September 23rd, 1908. The total registration for the session was forty-five, four of whom were students taking graduate courses in the Department of Physics.

At the second session of the Second Legislature, November, 1910, a comprehensive measure reorganizing in large part the government of the University was introduced and passed into law. By the new act a Board of Governors was constituted, to consist of the Chancellor and the President of the University, ex officio, together with nine members to be appointed by the Lieutenant-Governor-in-Council; the functions of this Board may be defined generally as those of business management and administration, including the making of appointments to the teaching and office staff of the University, the handling of all University moneys and investments, and the supervision of buildings and grounds. The Senate, by this same act, was continued as a body entrusted with the general supervision of the University's educational work. It is defined by the statute to consist of the Board of Governors, the President, the heads of affiliated colleges, the Deans of the University Faculties, all ex-Chancellors or ex-Vice-Chancellors of the University, the Senior Principal of the Provin-

cial Normal Schools, and the Superintendent of Education for the Province ex-officio; of faculty representatives; of representatives of all societies whose examinations for status are conducted by the University ; and of ten members elected by Convocation. The prerogatives of the Senate include the field of student regulation and discipline, the approval of all educational schedules or programmes, and the establishing and conferring of degrees. The Convocation, under this act, is composed of all graduates of the University, and of all resident graduates of British and Canadian universities who registered under the University Act of 1906. The Convocation is empowered to consider all questions affecting the well-being of the University and to make representation thereupon to the Board and to the Senate.

Comformably with the provisions of this act, late in December, 1910, the Lieutenant-Governor-in-Council appointed nine members of the Board of Governors, who met early in January, 1911, and organized by electing E. C. Pardee, Esq., of Edmonton, Chairman. An election for members of the Senate, in accordance with the terms of the act, was ordered. By March 8th the elective members of the Senate had been chosen, and the new Senate held its first meeting for the transaction of business on March 31st, 1911, completing among other items arrangements for the first graduation exercises of the University. These took place on May 16th, 1911.

During the summer of 1911 Athabasca Hall, the first building of the University scheme to be completed, was made ready for occupation, and lectures were given for the first time on the University grounds in September of that year. At the same time excavations were begun for a second hall of a similar nature. This became available for partial occupation in October 1912, and in its entirety by the beginning of 1913 under the name of Assiniboia Hall. In the autumn of 1913 the foundations of the third building, Pembina Hall, were laid, and in October 1914 a considerablle part of it was ready for use as class-rooms. This building will continue during the

academic year 1915-16 to be used for purposes of instruction; in it also is situated the consulting office of the University Medical Service.

From its very beginning the University of Alberta has undertaken extension work in the form of lectures by members of its staff in a number of important provincial centres, but special emphasis was laid upon this side of the University's activities by the appointment in May, 1912, of a special Secretary of the Department of Extension. This officer undertook the task of systematizing the extension work in such a way as to enable the University to achieve more fully the important function of reaching in its educational work the people of the province at large.

The Department of Extension also inaugurated in 1913 a press bulletin, a system of travelling libraries, and a bureau of information from which literary clubs and debating societies can obtain briefs on issues of all sorts. It organized in the same year a high school debating league which has stimulated very remarkedly the interests of the secondary schools of the Province in argumentation and public speaking. A new departure in 1915 was the presentation to Edmonton and Calgary audiences of a series of discussions on the social problems of western Canadian life.

The year 1912 saw another development of the University's activity in the creation of a Faculty of Law; this was effected by a resolution of the Senate under date of October 3rd, upon which the Board of Governors took favorable action shortly afterwards. A three year course leading to the degree of LL.B. was established, and thirty-five students were enrolled for the first session of the new faculty. In 1914 this course, portions of which coincide with the requirements of the Alberta Law Society, was extended to cover four years.

In the autumn of 1913 the Department of Civil Engineering and its allied subjects ceased to form a portion of the original Faculty of Arts and Sciences, and were constituted

a new faculty under the name of the Faculty of Applied Science. At the same time the fourth University faculty came into existence, and instruction began in the Faculty of Medicine. Twenty-six students constituted the first class in this faculty, and arrangements have been perfected to carry them through at least three years of a five year course, with the privilege of being then transferred, if necessary, with full standing to certain Eastern universities. Under the Faculty of Medicine a Department of Pharmacy has been organized; instruction in this Department began in October 1914, designed to prepare students to satisfy the requirements of the Pharmaceutical Association of Alberta. Features of interest in connection with the Faculty of Medicine are the University Medical Service whereby the health of all students is supervised in a very direct manner, and the outdoor clinics given at the city hospitals by members of the faculty.

In December, 1913, the contracts were let for the construction of the Arts Building of the University, and another stage in building operations was thus definitely entered upon. This fine structure, which will rank high among the public buildings of the Province, will be ready for occupation in September, 1915.

UNIVERSITY GROUNDS

The University is situated in the City of Edmonton on the south bank of the Saskatchewan River, immediately opposite the Legislative Buildings. The University campus consists of two hundred and fifty-eight acres of land with a frontage on the river of twenty-one hundred feet and an elevation above the valley of about two hundred feet.

A complete plan has now been developed for the beautification of the campus and for the arrangement upon a definite system of all future University buildings. This scheme is the work of eminent Canadian architects and designers and represents a singularly fortunate combination of convenience and artistic taste.

By September, 1915, there will be ready for use a handsomely turfed athletic field surrounded by a quarter-mile cinder-track.

UNIVERSITY BUILDINGS

In accordance with the plan mentioned above there are at present three buildings of what may be called the "residence unit" completed. Of these Assiniboia is the most northerly; it provides residential accommodation for one hundred and twenty-five students. The central building of these three is Athabasca Hall, similar in general design and arrangement to Assiniboia Hall, and accommodating about the same number of residents. From its rear extends the University dining-room, a handsomely finished hall which serves at present for most of the University's social functions also; beyond the dining-room lies the gymnasium, equipped with the most recent apparatus and adapted for various indoor games. Pembina Hall, the south member of the group, resembles the other two in general plan, but represents a rather higher type of building construction and finish. For the next year it will be principally devoted to teaching purposes.

The main University building, standing close to the north-east corner of the University grounds, is a three-storey structure in the neo-classic style of architecture; it is built of tapestry brick in blending shades of brown and red, with pillars and trimmings of Indiana limestone. In the interior finish a combination of beauty with the most modern teaching conditions has been consistently sought.

This building contains the offices of the President of the University and of its various executive heads, the university library, a number of lecture rooms, the laboratories of the Faculty of Arts and Science in geology, mineralogy, biology, chemistry, physics, and psychology, the offices of the Extension Department, and the university printing press. From

its rear extends an assembly hall with capacity for one thousand persons, and so fitted as to be available for theatrical presentations.

During the summer of 1915 one section of the engineering shops will be completed, and in this the practical work of the Faculty of Applied Science will be given, while for lecture purposes this Faculty will share with the Faculty of Arts and Sciences in the use of the rooms of the main university building.

The Board of Governors of the University has made provision for the accommodation upon the campus of affiliated colleges as part of the University system. The Board of Alberta College, the theological training school of the Methodist Church for this Province, has erected on the portion set aside for it a residential and teaching building, affording quarters for over one hundred students; this building was opened for classes in September, 1911. A similar allotment of land has been made to the Board of Robertson College, the theological training school of the Presbyterian Chucrh for Alberta, and plans are being prepared for the erection of a suitable teaching and residential building thereon. In the meantime the college, which began work in September, 1911, is conducting its classes in temporary quarters in the City of Edmonton.

In February, 1914, the formal opening took place of the newest of the City of Edmonton's hospitals, known as the Strathcona Hospital, built at the city's expense upon a site provided by the Governors of the University. The importance of this building, not merely as an ornament to the University grounds, but to the development of the Faculty of Medicine, can hardly be over-rated. The outdoor clinic maintained at the city hospitals by the Faculty of Medicine has already been mentioned.

LABORATORY EQUIPMENT

I—ANATOMICAL LABORATORY

The laboratory equipment for histology, splanchnology and embryology includes compound and dissecting microscopes for each student; binocular and other microscopes for demonstrations of special preparations; microtomes for cutting sections by freezing or by imbedding in paraffin or in celloidin; charts, models and prepared specimens for study. Each student is furnished with representative series of permanent sections, besides being supplied with fresh material for study in the laboratory. The rooms for practical work in gross anatomy are all on the second floor and are well lighted and each supplied with hot and cold water. Models, prepared dissections, charts and lantern slides are used to supplement the student's own work.

II—BACTERIOLOGICAL LABORATORIES

The Department of Bacteriology with which is incorporated the Provincial Health Laboratory of the Province is equipped with all the latest apparatus for the teaching of this science.

The Laboratory has been completely fitted out with electric and gas incubators, electric centrifuges, darkfield illuminator, electric, dryair, and steam sterilizers, and apparatus for the making of vaccines.

All the bacteriological material from the provincial laboratory including specimens of water, milk, sputum, etc., are available for teaching purposes.

A departmental library consisting of books, journals, bulletins, and reports on all branches of public health and bacteriological work has been collected and is kept up to date.

III—BIOLOGICAL LABORATORY

The Biological Department comprises a large laboratory used chiefly for botanical work, and a smaller room for zoological work.

The Department is equipped with 45 microscopes, dissecting microscopes and other necessary optical apparatus; apparatus for the study of plant physiology; and a greenhouse to furnish material for class work and research, and for carrying out experiments in plant physiology. The department possesses a large collection of lantern slides, microscope preparations and spirit material for class work and all the usual reagents for anatomical and physiological work. To illustrate the chief features of the various groups of plants, the nucleus of a museum collection has been provided, and it is hoped to augment this greatly during the present session. A small herbarium collection of local plants has been given by Mr. G. H. Gaetz, and this will be added to as early as possible so that the Department may possess a representative herbarium of the North American flora. The zoological laboratory contains the usual apparatus necessary for dissection work, together with spirit material and museum preparations. This will be materially increased during the present session.

IV—CHEMICAL LABORATORY

The Chemical Laboratories are equipped with adequate apparatus for both elementary and advanced courses. A sufficient number of analytical balances sensitive to 1-10 milligram are provided for the use of the student from the beginning of his laboratory course.

In addition to the equipment for instruction there have been provided special appliances for industrial and research work. These include flash-point, viscosity and penetration apparatus, a polariscope and a Mahler-Bomb calorimeter. By means of these such investigations may be carried on as the determination of the calorific power of coals, the chemical analysis of marls, clays and minerals, testing the lubricating quality of oils, and testing asphaltum.

V—GEOLOGICAL AND MINERALOGICAL LABORATORIES

The mineralogical laboratory is equipped to carry on descriptive mineralogy and blowpipe determinations of minerals. It contains collections of minerals for class use. In a wall case is exhibited a representative collection of economic ores arranged according to the metals which they contain.

In the petrographical laboratory are working collections of rocks and the laboratory is equipped with three polarizing Leitz microscopes of the Berkey model; one large research Bausch and Lomb petrographic microscope of the Wright model; one Zeiss binocular microscope ;a Ward rock trimmer; a Leitz machine,run by electric power, for cutting, grinding and polishing rocks, minerals and fossils, and giving all the necessary facilities for the preparation of thin sections for microscopic use; apparatus for the mechanical analyses of rocks; glass, wire and wooden models for use in crystallography; apparatus showing the mechanics of rock-folding as seen in mountain ranges; maps, folios, charts and models such as illustrate the cycle of development in the life history of physiographic forms .

A small dark room is used for optical crystallography and for photographic use in making lantern slides.

Some of the space in each of the laboratories is used for museum purposes. The mineral collection is arranged in table cases and consists of over 1500 speciments, labelled systematically according to the Dana classifiication. The collections of rocks, fossils, crystals and ores arranged and catalogue in table and wall cases number upwards of 2000 specimens.

The palaeontological collections, consisting of a small teaching collection of index fossils, has been substantially increased by a gift of upwards of 500 species from the Royal Ontario Palaeontological Museum at Toronto. These collections have been supplemented by a series of modern shells for

comparison with the fossilized forms, and also a few specimens of fossilized of Dinosaurs, collected from the bank of the Red Deer River, Alberta.

The museum collections have been increased by gifts from private individuals, Universities and mining companies in Canada and the United States. Mr. W. F. Ferrier of Toronto, has contributed largely to the minerals and ores, and has also supplied printed labels for the museum collections.

Large samples of coal from three to nine hundred pounds each have been presented by various coal companies in Nova Scotia.

A small clay laboratory is equipped with a dry press fitted with bricklet and tile molds; a hand wad box fitted with sewer pipe mold; a kiln for burning clay products.

VI—HYDRAULICS LABORATORY

A Hydraulics Laboratory which is expected to be ready for the session 1915-16 will be equipped with the following apparatus, part of which is at present in use: an experimental hydraulic tank for illustrating orifice discharge, weir flow, etc., a Pelton water wheel, a centrifugal pump, pipefriction and hydraulic gradient apparatus, reaction turbine and water engine, and apparatus for investigating the theory of impact on vanes. In addition to these, numerous measuring tanks, stand pipes for uniform pressure, and other appliances necessary for experimental work will be installed.

VII—INDUSTRIAL LABORATORIES

The department of Industrial Laboratories is equipped with apparatus for complete testing of materials. Chemical tests are made on rocks, ores, clays, oils, gases, fertilizers, etc. A complete assay outfit is installed for gold, silver and platinum work. Special equipment is provided for clay testing,

including presses, moulds, furnaces. Standard physical tests are made on materials of construction such as cement, gravel, concrete.

VIII—MINING ENGINEERING LABORATORIES

These laboratories will be equipped to carry on general experimental work in ore dressing, mining and metallurgy in the third and fourth years.

The ore dressing and mining equipment will include rock and coal breakers and grinders ,screens, and other general concentrating and washing machines.

The metallurgical equipment will include sampling apparatus and assay furnaces for the sampling and fire assaying of gold and silver, copper and lead, ores, etc.; also apparatus for carrying on general experimental work in metallurgy.

IX—PHYSICAL LABORATORIES

Laboratory classes at present are conducted in three rooms, one of whiich is reserved for more advanced work by senior students. All rooms are equipped with water and gas, and both direct and alternating electric current.

The apparatus for lecture demonstrations is kept in the laboratories, as well as that required for the regular classes in laboratory instruction.

The junior laboratories are equipped with instruments and apparatus necessary to perform elementary experiments, mostly quantitative, in the subjects of properties of matter, mechanics, heat, light, sound, magnetism and electricity. The more delicate and exact apparatus is reserved for the senior laboratory, which has, in addition, an equipment of electrical instruments suitable for commercial or scientific testing. In the latter are included the instruments usually required for determination in radio-activity.

Instruments required for electrical engineering will for the present be kept in the physical laboratory, and the department in consequence is being equipped with direct and

alternating current voltmeters, ammeters, wattmeters, current balances, dynamometers, standard resistances and condensers.

X—PHYSIOLOGICAL AND PHARMACOLOGICAL LABORATORIES

This equipment has been installed to familiarize the student with the methods of physiological research and to enable him to verify for himself the established phenomena in physiology. This individual work is supplemented by class demonstrations in mammalian physiology . Graphic records are made in illustration of the action of drugs on living organs. Complete equipment for the use of X-Rays in the study of physiology in the senior courses, and in the methods of diagnosis in clinical physiology is installed in the Strathcona Hospital.

CLINICAL LABORATORY

The laboratory at the Strathcona Hospital is equipped for the full examination of speciments of urine, sputum, blood, gastric contents and other clinical materials.

MEDICAL CHEMICAL LABORATORIES

These laboratories are provided with complete equipment for each student for the study of animal biochemistry in the second year and pathological chemistry in the third year of the medical course.

PATHOLOGY LABORATORY

This laboratory is fitted with compound microscopes, microtomes, specimen jars and all accessories for the study of gross and microscopical pathology. The autopsy room at the Strathcona Hospital is operated in conjunction with this laboratory.

PHARMACY LABORATORY

This laboratory is equipped with machines for the making

of compressed tablets, pills and suppositories; and also with balances and apparatus for the carrying out of the galenical preparations. This laboratory supplies the drugs for the Edmonton Hospital Board.

XI—TESTING LABORATORY

A Testing Laboratory has been equipped to carry out the standard tests on materials of construction such as concrete, sand, gravel, cement, brick, steel, brass, timber ,sewer pipe, and to investigate their physical characteristics. The equipment includes a 75-ton Riehlé testing machine for tests in tension and compression, a Fairbanks cement-testing machine with complete accessories, a standard abrasion cylinder, a Crosby gauge-testing apparatus, a torsional machine, appliances for testing moments of inertia and similar material for experimental work .

SURVEYING EQUIPMENT

The University has a complete outfit of surveying instruments of standard make for outdoor survey school work, a zenith telescope for latitude determination, and a meridian transit for accurate time determination.

EQUIPMENT OF THE ARCHITECTURAL DEPARTMENT

The Architectural Department has the nucleus of a collection of casts providing examples of form and ornament suitable for the study of style and for the practice of drawing. There is also a series of lantern slides illustrating a wide range of architectural subjects. The Library of the University possesses a valuable collection of works relating to architecture.

GYMNASIUM

The neessity of providing facilities for gymnastic exercise in the University has been met for the present by a gymnasium having a floor space of about 3,400 square feet, and an equipment of high bars, mats, dumb-bells, wands, etc., for free gymnastics, besides the requisite accessories of dressing-rooms and shower baths. A basement provides accommodation for boxing and wrestling. A gallery with a seating capacity of about 200, runs the full length of the gymnasium.

THE LIBRARY

The library comprises a reference room, a reading room where journals are kept, and a stack room.

There are now altogether over 12,000 volumes in the Library, besides a large number of pamphlets, blue-books and periodicals.

A feature of the library is a large collection of books, written by Canadians and about Canada, which was presented to the University by the Honorable A. C. Rutherford.

A valuable gift of books dealing with Anglo-Saxon and English literature has been received from Miss Marian Gill, B.A.

A gift of source materials in United States and Canadian History has been made this year, and is to be supplemented annually, by the Edmonton Branch of the Alberta Women's Association. This gift is "in commemoration of the hundred years of peace between Great Britain and the United States."

For the convenience of students, the University maintains a book store where text-books prescribed in the University calendar may be obtained. Gowns, drawing material, and athletic costumes may also be obtained at the book store.

Matriculation

CLASSIFICATION OF STUDENTS

The courses of study in the University leading to degrees in Arts are open to men and women on equal footing.

Except under special circumstances no student under sixteen years of age will be admitted to the first year, or under seventeen to the second year.

Students are classified as Graduate, Undergraduate, Conditioned, Partial and Special.

Graduate students are those who hold the Bachelor's degree (B.A. or B.Sc. in Arts) and are either pursuing special studies in advanced courses, or have been formally admitted by the Faculty Council, upon the recommendation of the Committee on Graduate Studies, to candidacy for the Master's degree.

Undergraduates are matriculated students who are taking a full undergraduate course leading to a degree. In order to become undergraduates, candidates must have passed the full matriculation examination of the University or some other equivalent examination.

Conditioned students are those who, not having completed their matriculation examination are, by permission of the Faculty Council, actually taking a full undergraduate course leading to a degree, and are entitled to obtain undergraduate standing on completing their matriculation. Candidates who present certificates of having passed Grade XI or XII examination of the Province of Alberta, or an equivalent, but have not taken all the subjects required for matriculation, may enter as conditioned students. The admission of a candidate failing in any part of his matriculation examination shall be at the discretion of the Faculty Council.

For students who are deficient in the language subjects and are admitted as conditioned students, special preparatory classes are provided. Beginning with September 1916, stu-

dents coming from schools where the languages are taught will not be admitted to these classes.

Partial Students.—Undergraduate and Conditioned students who have registered for a full undergraduate course but who, during the session, drop two courses, thereby become **Partial** students.

Special students are those who, not belonging to one of the above classes of students, are pursuing the study of particular subjects. Such students may, subject to the approval of the Faculty Council, attend classes without previous examination.

MATRICULATION EXAMINATIONS

Matriculation examinations are annually held at two fixed dates, one in June and one in September. The June examination is held, under the direction of the Department of Education, at all the High School centres throughout the Province of Alberta, and in 1915 begins on the 24th of that month. The September examination is held at the University only, and in 1915 begins on the 15th of that month. In addition to these, arrangements may be made for holding local examinations elsewhere, if application is made before May 1.

In each subject 40% of the assigned number of marks is required for a pass.

All enquiries concerning these examinations, except that held in June, should be addressed to the Registrar, University of Alberta, Edmonton, Alberta.

Students who have passed Grade XI of the course of study of the Province of Alberta in the subjects required for matriculation are admitted as undergraduates to the first year of the University in the various courses leading to degrees.

SECOND YEAR ENTRANCE

Students who present a Grade XII certificate of the school course of the Province of Alberta or a corresponding certificate from any other province of Canada may enter the

second year, provided that the courses from which they receive exemption on account of such certificate together with the courses completed after entering the University shall be the full number of courses required for the degree and shall include the compulsory subjects.

MATRICULATION SCHOLARSHIPS

In 1916 there are offered eight scholarships of $25 each, given by the Senate and the Board of Governors of the University.

Four of these scholarships will be awarded on the results of the Grade XI examinations set by the Provincial Department of Education in conjunction with professors of the University. Candidates from private schools may also compete.

The other four scholarships will be awarded on the results of the special matriculation examinations held in May for the affiliated colleges. Two of these scholarships are available for those candidates taking the examination in Edmonton, the other two for those in Calgary. Only those candidates who write on the whole of the matriculation examination and pass in each subject thereof will be eligible for these scholarships.

EQUIVALENT EXAMINATIONS

Certificates of having passed the whole or part of any of the following examinations may be accepted, *pro tanto*.

Province of Alberta: The Grade XI and XII examinations.

Province of British Columbia: The Junior, Intermediate, and Senior Grade examinations.

Province of Saskatchewan: The Middle and Senior Forms (High School examinations).

Province of Manitoba: The Second Class Non-Professional Teacher's Certificate examination.

Province of Ontario: The Junior and Senior Teachers'

Certificate examinations; the Junior and Senior Matriculation examinations.

Province of Quebec: The Associate in Arts examination. Grades XI and XII.

Province of New Brunswick: The examinations for Superior and Grammar School Licenses.

Province of Nova Scotia: The Leaving examination Grades XI and XII.

Province of Prince Edward Island: The Leaving examination of Prince of Wales College. The examination for First Class Teachers' Licenses.

Newfoundland: The Intermediate and Associate examinations.

Great Britain and Ireland: The Local examinations of the leading Universities and the Leaving examinations of the Scotch and Irish Education Departments.

Requests for exemption from the matriculation examination based on certificates other than those mentioned above, will be considered on application.

ADMISSION AD EUNDEM STATUM

Any student of another university wishing to be admitted to this university with equivalent standing is requested to send with his application:

1. A calendar of the university in which he has studied.
2. A complete statement of the course of study he has followed.
3. A certificate of standing and conduct from the university in which he has studied.

MATRICULATION EXAMINATION REQUIREMENTS

Every candidate for the September matriculation examination is required to fill up an application form and return the same to the Registrar of the University not later than August 15. Blank forms may be had on application.

For the June examination, candidates should apply to the Deputy Minister of Education, Government Buildings, Edmonton.

The subjects of the matriculation examination are as follows:

I.—For those intending to take the B.A. course:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**
4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**
8. **Geometry, Part I.**
9. **Latin.**

10 and 11. Two of the following: **French, German, Greek, Elementary Science (Physics or Chemistry).**

II.—For those intending to take the B.Sc. course in Arts:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**
4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**
8. **Geometry, Part I.**
9. **French.**
10. **German.**
11. **Physics,** or **Chemistry,** or **Latin.**

III:—For those intending to take the B.Sc. course in Engineering:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**

4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Parts I and II.**
8. **Geometry, Parts I and II.**
9. **Trigonometry.**
10. **French or German.**
11. **Chemistry or Physics.**

For Session 1916-17 and thereafter Physics and Chemistry will be obligatory.

IV.—For those intending to take the B.Sc. course in Architecture:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**
4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**
8. **Geometry, Part I.**
9. **French.**
10. **Physics.**

Students entering the Architectural Course are required to submit drawings (not more than six in number) on sheets 15 ins. x 11 ins.; the subjects to be plant or other common forms drawn from actual objects, not copied from drawings.

V.—For those intending to take the M.D. course:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**
4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**

8. **Geometry, Part I.**
9. **Latin.**
10. **Chemistry.**
11. **Physics.**
12. **French or German.**

VI.—For those intending to take the LL.B. course the requirements are identical to those for the B.A. course (see above, Sect. I.)

VII.—For those intending to take the course for the Degree of Bachelor of Pharmacy:

1. **English Grammar.**
2. **English Composition and Dictation.**
3. **English Literature.**
4. **British and Canadian History.**
5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**
8. **Geometry, Part I.**
9. **Latin.**
10. **Chemistry.**
11. **Physics.**

In the case of students who only wish to take the Diploma at end of the first year, the Grade X examination of the Department of Education of Alberta, or its equivalent, is accepted.

Note:—The certificate of the above matriculation standing should be filed with the Registrar before the student commences his period of apprenticeship. The conditions of apprenticeship may be obtained from the registrar of the Alberta Pharmaceutical Association.

VIII.—For those intending to take the course for the diploma in Accountancy:

1. **English Grammar.**
2. **English Composition and Dictation.**

3. **English Literature.**
4. **British and Canadian History.**
*5. **General History.**
6. **Arithmetic.**
7. **Algebra, Part I.**
*8. **Geometry, Part I.**
9. **French or German.**
10. **Physics or Chemistry.**

The Primary examination of the Institute of Chartered Accountants of Alberta will be accepted in these subjects *pro tanto*.

DETAILS OF THE MATRICULATION SUBJECTS

English:

* (a) Grammar—The general principles of English Grammar.

(b) Composition and Dictation.

Candidates will write a theme of not less than two pages on a subject, to be given at the time of examination. This theme will be supplemented by questions on the general principles of Rhetoric. Text-book—Gardiner, Kittredge and Arnold, *Manual of Rhetoric* (Ginn).

The examination in spelling and punctuation will consist of a selection of English prose reproduced by the candidate from oral dictation.

(c) Literature—Every candidate is required to pass an examination based on the following texts. Precise knowledge of the subject matter and a reasonable acquaintance with form will be expected.

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* An equivalent in Physical and Commercial Geography will be accepted for General History, and an equivalent in Book-keeping for Geometry.

*Candidates who present certificates from the Department of Education showing that they have succesfully completed these subjects in the regular school course will be exempted from examination therein.

Poetry: Shakespeare: Julius Caesar.
Tennyson: The Passing of Arthur.
Selected Lyrics (Palgrave's Golden Treasury).
"Eternal Spirit of the chainless Mind" (Byron).
"When I have borne in memory what has tamed" (Wordsworth).
"O Friend, I know not which way I must look" (Wordsworth).
"If aught of oaten stop or pastoral song" (Collins).
"O Wild West Wind, thou breath of Autumn's being" (Shelley).
"Ye distant Spires, ye antique towers" (Gray).
"Of a' the airts the wind can blaw" (Burns).
"Why weep ye by the tide, ladie" (Scott).
"Our bugles sang truce, for the night-cloud had lower'd" (Campbell).
"From Stirling Castle we had seen" (Wordsworth).
"And is this—Yarrow—This the stream" (Wordsworth).

Note—Choice selections from the above poems should be memorized.

Prose— Macaulay: Pitt.
Goldsmith: The Vicar of Wakefield.

Collateral Reading:

Irving: Life of Goldsmith.
Thackeray: Esmond.
Goldsmith: The Deserted Village.

History:—

*The outlines of British History from 1066 to the present.

*The outlines of Canadian History.

The outlines of general European History to the beginning of the Renaissance.

* See footnote p. 41

*Arithmetic:—

All the ordinary rules including square root and the metric system.

Algebra, Part I.:—

Natural numbers, zero and negative numbers, fractions; simple equations of one, two and three unknowns; graphs; problems; factoring, highest common factor, least common multiple ;equations with fractions; quadratic equations, and equations solved like quadratics; surds, indices; algebraic and graphical solution of equations of the second degree. Tory and Birchard, *Elements of Algebra* (Gage); or Hawkes, Luby and Touton, *First Course in Algebra* (Ginn).

Algebra, Part II.:—

The three progressions, ratio, proportion, variation, permutations and combinations, binomial theorem, logarithms. Hawkes, Luby and Touton, *Second Course in Algebra* (Ginn).

Geometry, Part I.:—

The constructions and theorems of the following list; deductions and applications. Baker, *Geometry for Schools* (Gage).

To construct a triangle of which the sides shall be equal to three given straight lines, any two of which are together greater than the third.

The angles at the base of an isosceles triangle are equal. If two angles of a triangle be equal, the sides opposite to them are also equal.

If the three sides of one triangle be respectively equal to the three sides of another triangle, the triangles are equal in every respect.

At a given point in a given straight line to construct an angle equal to a given angle.

If two triangles have two sides of one equal respectively to two sides of the other, and the included angles equal, the triangles are equal in all respects.

If two triangles have two angles of the one equal to two angles of the other, each to each, and therefore the third angles in each equal and a side of the first equal to the corresponding side of the other, the triangles are equal in all respects.

If two sides of one triangle be respectively equal to two sides of another triangle, and the angles opposite to one pair of equal sides be equal, then the angles opposite to the other pair of equal sides

*Candidates who present certificates from the Department of Education showing that they have successfully completed these subjects in the regular school course will be exempted from examination therein.

are either equal or supplementary; and if equal, then the triangles are equal in all respects.

To bisect a given angle.

To bisect a given straight line.

To draw a perpendicular to a given straight line from a given point in it.

To draw a perpendicular to a given straight line of unlimited length from a given point not on the line.

To find the locus of a point which moves so that its distances from two given straight lines are equal to one another.

To find the locus of a point which moves so that its distance from two fixed points are equal to one another.

To find a point which is equidistant from three given straight lines

To find a point which is equidistant from three given points.

The sum of all the interior angles of a polygon of n sides is equal to 2n-4 right angles.

If the sides of any polygon be produced in order, then all the exterior angles so formed are together equal to four right angles.

If one side of a triangle be greater than another side, the angle opposite the greater side is greater than the angle opposite the less.

If one angle of a triangle be greater than another, the side opposite the greater angle is greater than the side opposite the less.

The perpendicular is the shortest line that can be drawn from a given point to a given line; and a line nearer to the perpendicular is less than one more remote.

If from the ends of one side of a triangle there be drawn two straight lines to a point within the triangle, these two straight lines are together less than the sum of the two other sides of the triangle.

If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of the one greater than the angle contained by the two sides of the other; then the base of that which has the greater angle is greater than the base of the other.

If two triangles have two sides of the one equal to two sides of the other each to each, but the base of the one greater than the base of the other; then the angle contained by the sides of that which has the greater base is greater than the angle contained by the sides of the other.

To draw a straight line through a given point, parallel to a given straight line.

If a straight line falling on two other straight lines make (1) the alternate angles equal, and (2) the two interior angles on the same side together equal to two right angles, then the two straight lines are parallel.

If a straight line falling on two other rstraight lines make (1) the alternate angles equal to one another, or (2) the two interior angles on the same side together equal to two right angles, then the two straight lines are parallel.

Straight lines which join the extremities of equal and parallel straight lines towards the same parts are themselves equal and parallel.

The opposite sides and angles of a parallelogram are equal to one another and each diagonal divides the parallelogram into two triangles equal in all respects.

Parallelograms on the same base and between the same parallels are equal in area.

Parallelograms on equal bases and between the same parallels are equal in area.

Triangles on the same base and between the same parallels are equal in area.

Triangles on equal bases and between the same parallels are equal in area.

Triangles ,equal in area, on the same base, or on equal bases that are in the same straight line, and on the same side of the base line, are between the same parallels.

If a triangle and a parallelogram be on the same base and between the same parallels, the parallelogram is double the triangle.

The complements of the parallelograms about the diagonal of any parallelogram are equal in area.

To describe a parallelogram equal to a given triangle and having an angle equal to a given angle.

To describe a parallelogram equal to a given recti lineal figure and having an angle equal to a given angle.

On a given straight line to describe a parallelogram equal to a given triangle, and having an angle equal to a given angle.

Triangles of the same altitude are to one another as their bases

If a straight line be drawn parallel to one side of a triangle, it cuts the other side proportionally. And conversely, if a straight line cut two sides of a triangle proportionally, it is parallel to the third side.

If a vertical angle of a triangle be bisected by a straight line which also cuts the base, the segments of the base have the same ratio which the other sides of the triangle have to each other.

If the interior angle at the vertex of a triangle be bisected by a straight line which also cuts the base produced, the segments of the base have the same ratio which the other sides of the triangle have to each other.

Conversely, if the segments into which the base is divided externally have the same ratio which the sides of the triangle have to each other, the straight line drawn from the vertex to the point of section bisects the exterior angle at the vertex.

If two triangles are equiangular, the ratios of corresponding sides are equal.

If the ratios of the three sides of one triangle to the three sides of another triangle, taken in order, be equal, the triangles are equiangular.

If two triangles have one angle of the one equal to one angle of the other, and the sides about the equal angles proportional, the triangles are equiangular.

If the ratios of two sides of one triangle to two sides of another triangle be equal, and if the angles opposite to one pair of these sides be equal, the angles opposite to the other pair of sides are either equal or supplementary.

To divide a given straight line similarly to a given divided straight line.

To find a fourth proportional to three given straight lines.

If two triangles are similar, the ratio of their areas is equal to the ratio of the squares on their corresponding sides.

In a right-angled triangle, if a perpendicular be drawn from the right angle to the hypotenuse, the triangles on each side of it are similar to the whole triangle and to one another.

In a right-angled triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

In any triangle the square on the side opposite any angle according as the angle is obtuse or acute, is greater or less than the sum of the squares on the sides containing the angle by twice the rectangle contained by either of these sides and the projection on it of the other side.

If the sum of the squares on two sides of a triangle be equal to the square on the third side, the angle opposite this third side is a right angle.

To find the centre of a given circle.

If from a point within a circle more than two equal straight lines can be drawn to the circumference, that point is the centre of the circle.

If a chord of a circle move parallel to itself from the centre to the extremity of the diameter to which it is always at right angles, it continually decreases and ultimately vanishes.

If one end of a straight line be fixed and the other end move on the circumference of a circle, the line is greatest when it contains the centre and least when, on being produced, it passes through the centre; and as the moving end of the line advances from the latter to the former position, the line continually increases.

The angle at the centre of a circle is double of any angle at the circumference, standing on the same arc.

Angles in the same segment of a circle are equal.

The vertices of all equal angles standing on the same base and on the same side of it lie on a segment of a circle passing through the extremities of the base.

The opposite angles of a quadrilateral inscribed in a circle are together equal to two right angles.

If two opopsite angles of a quadrilateral be together equal to two right angles, the circle which passes through three of its angular points also passes through the fourth.

The angle in a semi-circle is a right angle; the angle in a segment greater than a semi-circle ,is less than a right angle, and the angle in a segment less than a semi-circle is greater than a right angle.

In equal circles, angles, whether at the centre or at the circumference have the same ratio as the arcs on which they stand; so also have the sectors.

A tangent to a circle is at right angles to the radius drawn to the point of contact.

If two circles touch ,the straight line joining their centres, produced if necessary, passes through the point of contact.

To draw a tangent to a given circle from a given point.

If a straight line touch a circle and from the point of contact a chord be drawn, the angles between the chord and the tangent are equal to the angles in the alternate segments of the circle.

On a given straight line to construct a segment of a circle containing an angle equal to a given angle.

From a given circle to cut off a segment containing an angle equal to a given angle.

In a given circle to inscribe a triangle equiangular to a given triangle.

To find the loci of the centres of circles touching two given straight lines.

To inscribe a circle in a given triangle.

About a given circle to describe a triangle equiangular to a given triangle.

If two chords of a circle intersect, either within or without the circle, the rectangle contained by the segments of the one is equal to the rectangle contained by the segments of the other; and if the point of intersection be without the circle, the rectangle contained by the segments of a chord is equal to the square on the tangent from that point.

If AOB and OC be two straight lines, and $OA.OB = OC^2$ then OC is a tangent to the circle through the points A, B and C.

To construct a rectilineal figure similar to a given rectilineal figure and having its sides to those of the given figure in a given ratio.

Two similar polygons may be so placed that the lines joining corresponding angular points are concurrent.

The areas of similar polygons are as the squares on corresponding sides.

If similar polygons be described on the sides of a right-angled triangle the area of that on the hypotenuse is equal to the sum of the areas of those on the two other sides.

To find the mean proportional between two given straight lines.

To construct a rectilineal figure similar to a given rectilineal figure ,and such that the areas of the figure shall be in a given ratio.

To describe a rectilineal figure which shall be similar to one and equal to another given rectilineal figure.

If there be two straight lines one of which is divided into any number of parts, the rectangle contained by the two straight lines is equal to the sum of the rectangles contained by the undivided line and the several parts of the divided line.

If a straight line be divided into any two parts, the square on the whole line is equal to the sum of the squares on the two parts, together with twice the rectangle contained by the parts.

If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts together with the square on the line between the points of section is equal to the square on half the line.

If a straight line be divided into any two parts, the sum of the squares on the whole line and on one of the parts is equal to twice the rectangle contained by the whole line and that part, together with the square on the other part.

If a straight line be divided into two equal parts and also into two unequal parts, the sum of the squares on the two unequal parts is double the sum of the squares on half the line and on the line between the points of section.

Geometry, Part II:—

The constructions and theorems of the following list;

deductions and applications. Baker, *Geometry for Schools; Analytical Geometry for Beginners;* (Gage).

In any triangle, the square on the side opposite any angle, according as the angle is obtuse or acute, is greater or less than the sum of the squares on the side containing the angle by twice the rectangle contained by either of these sides and the projection upon it of the other.

To divide a straight line so that the rectangle contained by the whole line and one segment may be equal to the square on the other segment.

To describe an isosceles triangle having each of the angles at the base double the third angle.

To construct a regular pentagon in a circle.

To draw a common tangent to two given circles.

If the vertical angle of a triangle be bisected by a straight line which also cuts the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the segments of the base, together with the square on the straight line which bisects the angle.

If from the vertical angle of a triangle a straight line be drawn perpendicular to the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the perpendicular and the diameter of the circum-circle.

The rectangle contained by the diagonals of a quadrilateral inscribed in a circle is equal to the sum of the two rectangles contained by its opposite sides.

If three concurrent straight lines be drawn from the angular points of a triangle to meet the opposite sides, then the product of the three alternate segments, taken in order, is equal to the product of the other three segments And, conversely, etc.

If a transversal be drawn to cut the sides, or the sides produced of a triangle, the product of the three alternate segments, taken in order, is equal to the product of the other three segments. And, cenversely, etc.

To divide a given straight line internally and externally so that the segments may be in a given ratio; that is to divide a given straight line harmonically.

If A, B, C, D be harmonic range, and therefore OA, OB, OC, OD a harmonic pencil; and if a line through C parallel to OA, meet OB, OD in X and Y respectively, then CX=CY.

If A, B, C, D be a harmonic range, and therefore OA, OB, OC, OD a harmonic pencil; and if another transversal cut the pencil in A' B', C', D', then A', B', C', D' form a harmonic range.

Elementary Analytical Geometry: the point, the straight line, the circle.

I. Position of a point in a plane. Coordinates.

II. Equations and loci.
   (a) Equations of loci and graphs.
   (b) Loci or graphs of equations.

III. The straight line.
   (a) A line defined by two points through which it passes.
   (b) A line defined by one point through which it passes, and by its direction.

(c) The general equation of the first degree.
IV. Change of axes.
V. The circle.
(a) The equation of the circle.
(b) Tangents and normals.

Trigonometry:—

Elements of Plane Trigonometry. Robbins, *Plane Trigonometry*. (Morang).

Physics:—

The equivalent of Grade XI or Grade XII of the public High Schools of Alberta. Merchant and Chant, *High School Physics*, omitting sections 32 to 38 inclusive, 90 to 94 inclusive, and chapters XL, XLVI, XLVII and XLIX.

Chemistry:—

Evans, *Elem. Chemistry for High Schools, Ch. I—XIV*, (Educ. Book Co.).

Latin:—

The Roman method of pronunciation is prescribed.

(a) Grammar. Accidence. Syntactical usages, especially the syntax of the cases, ablative absolute, accusative and infinitive clausess of purpose and result, noun clauses, time clauses, gerund and gerundive, conditional clauses, and indirect narration in detail.

(b) Composition. Translation into Latin of phrases and sentences illustrative of the syntactical usages outlined under Grammar, and also sentences based on the prose author read.

(c) Literature . Caesar, *de Bello Gallico*: Book IV., Chapters 20—38; Book V., Chapters 1—23.

Virgil, *Æneid*: Book I., complete.

Sight translation from easy prose authors.

Questions on the subject-matter of the texts prescribed.

Greek:—

(a) Grammar. The examination in this part of the work will be designed chiefly to test the student's mastery of Greek accidence.

(b) Composition. Short English sentences for translation into Greek, involving the more common idioms of Greek prose.

(c) Literature. Xenophon, *Anabasis IV.*, Chapters 1—7 inclusive.

Sight translation from the works of Xenophon, preferably the *Anabasis.*

Questions on the subject-matter of the text prescribed.

French:—

Grammar. Accidence and Syntax including translation of simple English sentences to test the candidate's familiarity with elementary grammar. Sight translation from modern French authors.

The authors prescribed for matriculation will be identical with those to be announced by the Department of Education for 1915-16.

German:—

Grammar. Accidence and Syntax including translation of simple English sentences to test the candidate's familiarity with elementary grammar. Sight translation from modern German authors.

The authors prescribed for matriculation will be identical with those to be announced by the Department of Education for 1915-16.

UNDERGRADUATE SCHOLARSHIPS, PRIZES AND MEDALS

SCHOLARSHIPS

Four scholarships of $50 each are offered by the Senate and the Board of Governors of the University. One of these scholarships is assigned to each of the first two years in Arts and one to each of the first two years in Applied Science. In each year, the scholarship is awarded to that student making the highest general average on the work of the session provided that a standing satisfactory to the Faculty Council be obtained.

Awarded (1911) to A. M. Munro, G. L. S. Kidd, and D. H. Telfer; (1912) to A. Bosomworth, S. R. Hosford, and L. S. MacDonald; (1913) to Miss J. M. Thatcher (by reversion to A. Telfer) and L. B. Brown; (1914) to Miss J. M. Thatcher, Miss H. J. Hotson (by reversion to G. S. Montgomery), A. J. Cook and C. A. Buck; (1915) to Miss M. L. Bowman, G. S. Montgomery, N. H. Atkinson and A. J. Cook.

One scholarship of $50 is offered by the Alberta Women's Association. This scholarship will be awarded to the women student who takes the highest standing in the work of the First Year of the Faculty of Arts and Sciences, provided that, to secure the award, an average of not less than seventy-five per cent. be obtained on the work of the year. Further, the award will be contingent upon the student's proceeding with the work of the second year and will be paid only after the student has been in actual attendance in the second year of her course.

Awarded (1911) to Miss Helen Montgomery; (1913) to Miss J. M. Thatcher (1914) to Miss H. J. Hotson; (1915) to Miss M. L. Bowman.

Five scholarships of $50 each are offered by the Council of Physicians and Surgeons of the Province of Alberta as follows:

One to the student taking the highest average marks in

the work of the freshman year. One to the student taking the highest marks in Physiology at the end of the third year. One to the student taking the highest average marks in Anatomy at the end of the third year. One to the student taking the highest average marks in Surgery at the end of the fifth year. One to the student taking the highest average marks in Medicine at the end of the fifth year.

PRIZES

1. Three prizes, of seventy-five, fifty and twenty-five dollars respectively, are offered by an anonymous donor for "proficiency in the study of the influence of the English Bible on English literature and speech." Open to students of the University, and of the affiliated colleges who have fully completed their matriculation and first year work. Competitors for the prizes are required to submit an essay dealing with the influence of the Bible on a given author (the name to be announced) and to write an examination, the questions of which will be designed to bring out the student's general knowledge of the Bible through his ability to identify and explain various allusions to, and quotations from, the Bible in contemporary literature.

Awarded (1912) to F. S. McCall, first prize; (1913) to W. Davidson, second prize, V. Leese, third prize; (1915) to D. H. Telfer, first prize, H. R. Leaver, second prize, S. Scott, third prize.

2. The Jane Alexander Memorial Prizes offered by Professor W. H. Alexander in memory of his mother who for twenty-five years served as assistant librarian to the Geological Survey of Canada.

(a) Latin Prose Composition and Sight Translation: Classical books to the value of ten dollars.

This competition is open to students who are regularly enrolled in Latin courses of the first, second and third years, but winners of the prize are debarred from competition in the year next following that in which they were successful.

Two special examinations are set, one in February on

Latin sight translation, and one in March on Latin prose composition.

Awarded (1912) to G. H. Holmes; (1913) to Miss J. M. Thatcher; (1914) to Miss M. A. Thatcher; (1915) to G. S. Montgomery.

(b) Geology: scientific (preferably geological) works to the value of ten dollars.

This prize is awarded to the student in Geology 51 and 52 making the highest standing in the work of the entire year as represented by the regular examinations and tests.

Awarded (1914) to W. S. McDonald; (1915) to R. B. Sandin.

3. Two prizes offered by Dr. A. Blais for French Composition, one of $15 for senior students and one of $10 for junior students.

Awarded (1914) to Miss J. M. Thatcher; (1915) to G. H. Holmes and Miss M. F. Cross.

MEDALS

1. The Governor-General's Medals. Two silver medals offered by His Royal Highness the Duke of Connaught, awarded one to the student in the Faculty of Arts and Sciences and one to the student in Applied Science, who at the end of the second year secures the highest standing in the eleven junior courses required in the first and second years, provided that an average mark of not less than 75% be obtained.

Awarded (1914) to Miss B. L. McLaughlin; (1915) to G. S. Montgomery and A. J. Cook.

2. The Charles Allan Stuart gold medal, offered by the Hon. Mr. Justice Stuart, Chancellor of the University, and open for competition to students in the graduating year, reading for honors in the Department of Classics.

Awarded (1912) to A. E. Ottewell; (1915) to G. H. Holmes.

3. The Alexander Cameron Rutherford gold medal, offered by the Hon. A. C. Rutherford, LL.D., and open for

competition to students in the graduating year, reading for honors in the Department of English.

Awarded (1912) to J. Adam; (1915) to S. R. Hosford.

4. The Alberta Women's Association gold medal, offered by the Association and awarded to that student in the graduating class of the Faculty of Arts and Sciences who takes the highest standing in the eight senior courses required in the third and fourth years, provided that an average mark of not less than seventy-five per cent. be obtained.

Awarded (1914) to Miss H. B. Montgomery; (1915) to W. R. Howson.

5. The John A. McDougall gold medal, offered by John A. McDougall, Esq., and awarded to the student taking the highest standing in the senior courses required in the last two years in Applied Science, provided, however, that an average mark of not less than seventy-five per cent. be obtained.

Awarded (1913) to W. M. Fife; (1915) to L. S. MacDonald; medal-prize W. S. McDonald.

6. The Grace Ferris Gold Medal in Modern Languages, offered by Mrs. W. D. Ferris, and awarded to the student who receives the highest standing in general courses in French and German of the third and fourth year, provided that the record of that student is considered satisfactory to the Council of the Faculty of Arts and Sciences.

Awarded (1914) to Miss J. F. Montgomery.

GRADUATE FELLOWSHIP

THE LLOYD HARTNOLL BISHOP MEMORIAL FELLOWSHIP IN ENGLISH LITERATURE

A fellowship in English Literature has been founded by E. T. Bishop, Esq., to be known as the Lloyd Hartnoll Bishop Memorial Fellowship, and to be conferred on the graduating student who, during his undergraduate course, has shown unmistakable evidence of literary ability. The present emolument of this Fellowship is $200.00. Attention is called to the fact that this is a special award and not necessarily given each year.

Awarded (1915) to H. R. Leaver.

THE RHODES SCHOLARSHIP

In addition to the preceding Scholarships, Prizes and Medals which are under the control of the University of Alberta, there is also available for the two provinces of Alberta and Saskatchewan ,one Rhodes Scholarship. The permanent committee of selection for the province of Alberta is as follows:

His Honor, the Lieutenant-Governor, Chairman.
The Honorable, the Chief Justice of the Province.
The Honorable, the Minister of Education.
The Chancellor of the University of Alberta.
The President of the University of Alberta.
Secretary of the Committee, D. S. MacKenzie, Edmonton.

Candidates must be at least in their sophomore year at a recognized degree-granting university or college of Canada, and (if elected) must complete the work of that year before going into residence at Oxford. Competitive examinations are held alternately in successive years in the two provinces under the auspices of the provincial committees. The next election in this province will be held in 1917. Each scholarship is tenable for three years, with a stipend of £300 per annum.

The following graduates of the University of Alberta have obtained this scholarship:

(1913) W. F. Dyde; (1915) H. G. Nolan.

UNIVERSITY REGULATIONS

I.—FEES

I.—In Arts:

(a) Undergraduates and Conditioned Students:	
Matriculation Fee	$ 5.00
Instruction per Session	20.00
Students' Union (compulsory)	5.00
(b) Special Students:	
Registration Fee	$ 2.00
Instruction per session per course	6.00
*Students' Union (compulsory)	2.50
(c) Graduate Students:	
Course for M.A.	$10.00
Course for M.Sc.	10.00
Students' Union (compulsory)	5.00

II.—In Applied Science:

(a) Undergraduates and Conditioned Students:	
Matriculation Fee	$ 5.00
Instruction per session, first and second years	40.00
Instruction per session, in subsequent years	60.00
Students' Union (compulsory)	5.00
(b) Special Students:	
Registration Fee	$ 4.00
Instruction per session per course	12.00
*Students' Union (compulsory)	2.50

III.—In Law:

Instruction per session	$10.00
Examination Fee	10.00
Students' Union (compulsory for students in attendance)	5.00

IV.—In Medicine and Pharmacy:

Instruction per session, first year	$50.00
Instruction per session, in subsequent years	75.00
Students' Union	5.00

V.—In Accountancy:

Instruction per session	25.00

*Special students taking taking two full courses in the University have, at registration, the option of paying the full Union Fee of $5.00 entitling them to full voting privileges.

VI.—Caution Money: Every student is required to deposit $5.00 caution money to cover damages done to furniture, apparatus, books, etc. This amount, less any necessary deductions, will be returned at the end of the session. Breakages exceeding this amount must be paid for before the student is permitted to take any examination.

VII.—For Room and Board in the Residences:

Room, per month	$ 8.00
Board, per week	4.50

VIII.—For Viséing Certificates 2.00

IX.—For Supplemental Examinations:

Each subject	$ 3.00

X.—For Degrees:

B.A. Degree	$ 5.00
B.Sc. in Arts	5.00
B.Sc. in Applied Science	10.00
M.A. Degree	10.00
M.Sc. Degree	10.00
LL.B. Degree	10.00

II.—REGISTRATION

All persons desiring to take courses in the University must register before being regularly enrolled. Registration may take place on and after the first day of September, and should be completed by the student in person on or before the 30th day of September, 1915. Students registering for the first time are requested to send their certificates for consideration early in September. Students applying for registration after the 4th day of October will be permitted to register only upon satisfying the Registration Committee as to the validity of their reasons for late entrance, and as to their ability to proceed with their courses. Application forms are to be filled in by the students and passed upon by the Registration Committee. Students are required to apply for subjects in which they are deficient before applying for other subjects. The Faculty Council reserves the right to adjust courses to meet the require-

ments of the time table. When the programme of work for which a student is applying has been approved, he may obtain his registration card through the Bursar's office on payment of the proper fees. This card must be presented to each instructor whose course the student enters. The instructor will initial the card and enter the name of the student on his class record. After the student has thus enrolled in all his courses he is required to return the registration card to the Registrar's office.

III.—ATTENDANCE

(a) Regular and punctual attendance at lectures and laboratory periods is required of each student. No student will be permitted to take the final examination in any course if his absences exceed ten periods in courses of three periods a week throughout the session, six periods in courses of two periods a week, on four periods in courses of one period a week.

(b) Lateness at any period of instruction may be excused by the instructor if reported by the student at the end of the period. A student who is late in bepinning the work of the session may apply to the Registrar for special consideration. Excuses for absence from periods of instruction on the ground of illness or domestic affliction must be submitted at once in writing to the Registrar. If this application be made on the ground of illness, the application must be accompanied by a doctor's certificate.

(c) Students desiring leave of absence in any given subject must communicate their desire to the Registrar. When such leave of absence has been granted the student is exempted from the operation of the attendance rule in section (a) above.

IV.—EXAMINATIONS

The University examinations are conducted by a University Examining Board appointed by the Senate and are

under the direction of the Controller of University Examinations.

1. Sessional Examinations.

(a) In Junior courses, as a rule, there are held three one-hour tests and one final examination. Ten per cent. of the whole credit in the course is assigned to each test. Tests in junior courses take place during the first week in November, the last week of lectures in December, and the third week in March.

In English 1 however, and in the courses numbered 3 and 4 in French, German, Greek and Latin, all of which are composition courses, tests are replaced by weekly exercises throughout the year, and to these exercises is assigned fifty per cent. of the whole credit in the course. The same arrangement exists with regard to Mathematics 1, where regular weekly exercises and short problem papers supplement the formal test papers.

(b) In some senior courses the test examination method is followed; under this arrangement tests fall during the last week of lectures in December and the third week in February, and fifteen per cent. of the whole credit in the course is assigned to each test. In other senior courses the assignment of thirty per cent. for term work is allotted to essays and practical examinations. Announcement is made at the beginning of the session as to the policy to be pursued in each department in this respect.

(c) In each course there is held a final examination. Seventy per cent. of the whole credit in the course is assigned to this examination, except in the case of certain junior courses referred to in paragraph (a) where the allotment is fifty per cent only. The final examinations are held at the end of the session except in courses completed before Christmas; in such courses the final examinations are held during the last week of lectures in December. In these courses the allotment of marks is seventy per cent. to the final examination and thirty per cent. to the test.

(d) When a student is absent from a test his mark for that test is zero. However, in case of illness or domestic affliction an application for aegrotat standing will be considered. The student must make written application at once to the Registrar; if this application be made on the ground of illness, the application must be accompanied by a doctor's certificate.

(e) When intercollegiate games or conferences fall within any period of tests, members and officers of teams and official delegates to conferences shall, at least one week before the beginning of the test period, make a requesst in writing to the Registrar in order that a readjustment of the time table may be considered.

(f) In the publication of standing in the various courses, students are grouped by classes, the first class comprising those who have obtained eighty-five per cent. and over, the second class those who have obtained between sixty-five and eighty-four per cent., and the third class those who have obtained between fifty and sixty-four per cent. No student is passed in any subject who fails to secure fifty per cent.

2. Supplemental Examinations.

Supplemental examinations are conducted by the University in September of each year for students who have failed in any course the preceding year, but whose attendance record is satisfactory. In reckoning standing for a supplemental examination the credits already obtained in the tests will apply as described above under Sessional Examinations. Students neglecting to take or failing to pass the supplemental are required to repeat the course. A fee of $3 is charged for each of these supplemental examinations. For any special examination granted by the Faculty Council to be held at any other time than the regular date for supplemental examinations a fee of $10 is charged for the first subject and $5 for each additional subject taken at the same time. Applications for permission to take the regular supplemental examinations must be on file with the Registrar not later than August 15.

V.—PROFESSIONAL EXAMINATIONS

Either by statutory provision or by agreement the examinations for the right to secure registration with the following professional societies in the Province of Alberta are under the control of the University Examining Board:—

The Alberta Land Surveyors' Association.
The College of Physicians and Surgeons of Alberta.
The Alberta Dental Association.
The Alberta Association of Architects.
The Law Society of Alberta.
The Alberta Pharmaceutical Association.
The Institute of Chartered Accountants of Alberta.

Information with respect to these examinations can be obtained on application to the Registrar.

VI.—PHYSICAL EDUCATION

The Department of Physical Education offers to all students the opportunity for physical development under scientific direction. Two hours a week physical drill is compulsory upon students of the first and second years. There is a medical examination of all students of these years to determine the fitness of the students for physical exercises and athletic activity. The work of this department is carried on in the University Gymnasium. (See page 31) The University reserves the right during the year 1915-16 to substitute military drill for these exercises.

VII.—DISCIPLINE

The Provost is the chief disciplinary officer of the University. He exercises general supervision over the conduct and welfare of the students, especially with regard to the students in residence.

By resolution of the Senate a committee on student affairs has been constituted as follows: "The President of the University, the Chancellor, the Chairman of the Board, the Provost, one member to be elected from each Faculty;

two members to be elected for the Senate (these not to be Faculty representatives); the Adviser to women students; the president of the Students' Union; the president of the Athletic Society; the president of the Literary Society; the president of the Wauneita Society; the editor-in-chief of "The Gateway"; three members to be elected from the Students' Council"

Under the same resolution, the duties of this committee are "to deal with

(a) all matters referred to in the University Act, Article 41, subsections 18 and 19.

(b) all other matters relating to students' interests not therein referred to, provided that in the event of any decision of this committee being challenged by a non-student member, the decision must, to be valid, be ratified by a majority of the non-student members present; provided further that the right of appeal to the Senate against any such decision shall lie with the student members."

(2) For misconduct in the lecture-room ,a student may be required by the instructor to leave the lecture-room. Persistent misconduct shall be reported to the President of the University, who may suspend from lectures pending the action of the committee on student affairs.

(3) The following disciplinary ruling with regard to Athletics, submitted by the Faculty of Arts and Sciences and the Students' Union, was adopted by the Senate at its meeting of March 31st, 1911.

"Hereafter no persons except *bona fide* students who are in attendance at the University, or at one of the group of organized affiliated colleges carrying full work and whose scholastic record is certified as satisfactory by the Faculty Council of the University, or by the respective college in which they are registered, shall be permitted to play on or be officers of any athletic team representing the University of Alberta.

By *bona fide* students shall be understood:

(a) students who are doing full undergraduate work in the University.

(b) in the affiliated colleges,

(1) students who are matriculated or (2) students taking two full courses in the University.' '

(4) In all cases of discipline involving offences against the student body, a student may appeal from decisions of that body or of any court constituted by it, to the Committee on Student Affairs.

(5) No student will be permitted to continue in attendance at the University whose presence is for any cause deemed by the Committee on Student Affairs prejudicial to the interests of the University.

VIII.—RESIDENCE

Residential accommodation is provided in the University for two hundred and fifty students. Unless by special permission, all students not living with parents or guardians must reside in the University residences. Applications for exemption must be addressed to the Bursar of the University.

Students already in residence in the University will be permitted to retain the rooms they at present occupy or to select other available rooms provided they give notice to the Bursar's office at or before the close of the session.

Other rooms available will be assigned in order of application.

Rooms will not be reserved later than Monday, September 28, unless a deposit of $8.00 is in the hands of the Bursar by that date and then only for two weeks.

The conduct of students in residence is subject to the authority of the House Committee, under the Board of Governors. This committee consists of the Provost, the Adviser to Women Students, two resident students from each of the University Halls; one representative of the women students in residence, and one non-resident student. A special

subcommittee of the House Committee, under the direction of the Adviser to Women Students, will deal with matters relating solely to the women students. The resident members shall be fourth year or graduate students and shall be elected at the Students' Union elections in the spring preceding, by the students then in residence; the non-resident student member shall be elected at the same time by the members of the Students' Union. Any vacancy thereafter occurring shall be filled at a special election to be held within two weeks after the occurrence of the said vacancy. Should the vacancy occur in the list of resident members, only students who have been in residence at least one year shall have the right to vote.

In all cases of discipline involving, or appearing to involve, the interests of the residences, a student may appeal from decisions of the Students' Union or of any student court to the House Committee.

IX.—MEDICAL SERVICE

All students registered in the University are required by the Students' Union to pay an annual fee of two dollars which is applied to the establishment of a Medical Service fund. This fund is administered by a committee consisting of the President of the University, the Provost, the Medical Director and the President of the Students' Union. In return for the fee paid, students are entitled to free medical treatment in case of illnesss or accident during the University session. This includes provision for hospital charges, nursing, medicine, ambulance, physician's fees and cost of minor operations. No provision, however, is made for cases of illness contracted before the beginning of the session, chronic diseases, or cases not immediately reported to the Medical Director. The Medical Director will in all cases decide if transference to the hospital is advisable and if so, what accommodation is necessary. He shall also decide who the attending physician shall be, and in case of operation shall determine to what consideration the patient is entitled.

X.—STUDENT FUNCTIONS

All student functions are conducted under the general supervision of the Provost, from whom permission to use a University building for such purpose must be obtained. A written communication for such permission must be addressed to him at least ten days before the date set for any function.

XI.—MEETINGS OF STUDENT SOCIETIES

Applications for the use of rooms for student meetings must be made to the Registrar.

XII.—ACADEMIC COSTUME

By a resolution of the Senate, students are required to wear gowns at all classes and lectures, and at such functions as may at any time be specified.

All gowns are to be of the customary Cambridge shape; i.e., for undergraduates a black stuff gown, not falling below the knee with round sleeve cut above elbow; for bachelors, a black stuff gown, falling below the knee with full sleeve cut to elbow and terminating in a point; for masters, a black stuff or silk gown falling below the knee with long sleeves with semi-circular cut at bottom.

Hoods are to be of the Oxford pattern, except those for the doctorate which shall be of the Cambridge form.

Bachelors' and masters' hoods are to be of a spruce green silk, with, for bachelors, a border (1½ inches each way); for masters ,afull lining of the color distinctive of the faculty.

The faculty colors are:—	**Green** and
For Arts (including LL.D.)	White
For Science	Light Green
For Law	Cream
For Medicine	Rose
For Agriculture	Pale Blue
For Education	Purple
For Dentistry	Buff
For Pharmacy	Cinnamon

Doctors' hoods are to be of scarlet silk, with a full lining of the respective faculty color, the M.D. hood to be of the master's pattern.

Doctors are entitled to wear a full dress scarlet robe faced with silk of the respective faculty color.

All caps are to be of the ordinary black trencher shape with black tassels, with a black velvet cap with gold cord for doctors' full dress.

Organization of Faculties

FACULTY OF ARTS AND SCIENCES

I.—THE B.A. DEGREE

The courses leading to the B.A. degree are divided into two groups—junior courses and senior courses. A course is to be regarded as designating normally three hours of instruction in a subject each week throughout the year. The junior courses are designed for students in the first and second years, the senior courses for the third and fourth years. The junior courses are, in general, to be regarded as preparatory to the senior courses.

To obtain the B.A. degree, a student must obtain credit for at least eleven junior courses and eight senior courses. The subjects in the junior courses are largely prescribed; the senior courses are in the main elective.

JUNIOR COURSES

FIRST YEAR

No.	Subject	Course No.	Lecture Hours	Page
1	English Composition	1	3	114
2	History	1	3	122
3	Mathematics	1 or 7	3	127
4	Physics	1	3	144
5-6	*French	1 and 3		134
	*German	1 and 3	3	137
	*Greek	1 and 3	3	109
	*Latin	1 and 3		107

*—Any **two** of these are to be taken.

SECOND YEAR

No	Subject	Course No	Lect. hours	Page
1	English	2	3	114
2-3	*French	2 and 4		134
	*German	2 and 4	3	137
	*Greek	2 and 4	3	110
	*Latin	2 and 4		107
4-5	†Biology	Bot. 1	3**	91
	†Chemistry	1	3**	94
	†History	2	3	123
	†Mathematics	7 or 51	3 or 4	128
	†Philosophy	1	3	147
	†Physics	3-9	3**	145

*—The two languages selected as first year courses are to be continued in the second year.

†Any **two** of these are to be taken. N.B.—History 2 is required of **all** second year students in session 1915-16.

**—Three hours a week of laboratory work is also required.

SENIOR COURSES
THIRD AND FOURTH YEARS

Group	Subject	Course No.	Lec. Hrs	Lab. hrs.	Page
		Hist.			
A. LITERARY AND PHILOSOPHICAL	Political Economy	59,60	3		125
	Education	51	3		144
	English	51-53	3		115
	French	51,52	3		135
	German	51,52	3		138
	Greek	51,52	3		110
	Hebrew	51,52	3		122
	History	53-58	3		123
	Italian	51	3		137
	Latin	51,52	3		108
	Philosophy	51-53	3		141
	Psychology	51,52	3		143
B. SCIENTIFIC	Astronomy	Mat 53	3		130
	Botany	51-55	3	3	91
	Chemistry	51-54	3	3	95
	Geology	51,55	3	3	116
	Mathematics	51,52	3		130
	Mineralogy	Geol53	3	3	117
	Physics	51-57	3	3	146
	Zoology	1	3	3	93

The senior courses are offered in the third and fourth years only. Of the eight senior courses for the B.A. degree one must be, and not more than three may be taken from Group B.

Students must continue two subjects throughout the two years, but are not permitted to select more than three courses in all from any one department, during the two years.

Students may be exempted from two senior courses selected from group A by presenting certificates of having satisfactorily completed an equivalent amount of work in one of the organized affiliated theological colleges.

II.—THE B.Sc. DEGREE IN ARTS

The courses leading to the B.Sc. degree in Arts are also divided into two groups—junior and senior courses. A course is to be regarded as designating normally three hours of instruction in a subject each week during the session. The junior courses are designed for students in the first and second years, the senior courses for students in the third and fourth years. The junior courses in general are to be regarded as preparatory to the senior courses.

To obtain the B.Sc. degree in Arts a student must obtain credit for at least eleven junior courses and eight senior courses. The junior courses are largely prescribed; the senior courses are in the main elective.

JUNIOR COURSES

FIRST YEAR

No.	Subject	Course No.	Lect. hours	Page
1	English Composition	1	3	114
2	French	1 and 3	3	134
3	German	1 and 3	3	137
4	History	1	3	122
5	Mathematics	1 or 7	3	127
6	Physics	1	3	144

SECOND YEAR

No	Subject	Course No	Lect. hours	Page
1	English	2	3	114
2	French	2 and 4	3	134
3	German	2 and 4	3	137
4-5	*Biology	Bot. 1	3†	91
	*Chemistry	1	3†	94
	*Mathematics	7 or 51	3 or 4	128
	*Physics	3-9	3†	145

*—Any two of these are to be taken.

†—Three hours a week of laboratory work is also required.

SENIOR COURSES
THIRD AND FOURTH YEARS

Group	Subject	Course No.	Lecture hours	Lab. Hrs.	Page
A. LITERARY AND PHILOSOPHICAL	Political Economy	History 59, 60	3		125
	Education	51	3		144
	English	51-53	3		115
	French	51,52	3		135
	German	51,52	3		138
	History	53-58	3		123
	Italian	51	3		137
	Philosophy	51-53	3		141
	Psychology	51,52	3		143
	Astronomy	Mat 53	3		130
B. SCIENTIFIC	Botany	51-55	3	3	91
	Chemistry	51-54	3	3	95
	Geology	51,55	3	3	116
	Mathematics	51,52	3		130
	Mineralogy	Geol53	3	3	117
	Physics	51-57	3	3	146
	Zoology	1	3	3	93

The senior courses are offered in the third and fourth years only. Of the eight courses for the B.Sc. degree in Arts one must be, and not more than three may be selected from Group A.

Students must continue two subjects throughout the two years, but are not permitted to select more than three courses in all from any one department, during the two years.

III.—COMBINED COURSES

1.—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND B.Sc. IN ARTS

To obtain the degrees of B.A. and B.Sc. in Arts a student is required to complete the following courses extending over six years:

JUNIOR COURSES

FIRST YEAR

1. English.
2. History.
3 & 4. Latin, Greek, French, German; two subjects to be chosen, one of which must be a modern language.
5. Mathematics.
6. Physics.

SECOND YEAR

1. English.
2 & 3. French and German.
4 & 5. Two of the following, one of which must be from (b):

(a) Latin, Greek, other Language, *History.

(b) Mathematics, Chemistry, Biology, Physics.

*History 2 is required of all second year students for session 1915-16.

Students who desire to take in the following years more advanced work in Mathematics, Physics or Chemistry must choose Mathematics in the second year.

SENIOR COURSES

THIRD AND FOURTH YEARS

In these two years a student must take eight courses from the senior courses prescribed for the B.A. degree, of which one must be, and not more than three may be taken from Group B.; one subject from Group A must be continued throughout the two years, but students are not permitted to select more than three courses in all from any one department during the two years.

At the end of the fourth year a student having satisfactorily completed the four years' work outlined above is entitled to receive the B.A. degree.

FIFTH AND SIXTH YEARS

In the last two years a student may take general courses for the ordinary degree of B.Sc. in Arts, or advanced courses in fewer subjects for the degree with honors.

For a general course the student must complete in the two years eight courses from Group B, subject to the conditions already stated (page 68) for the B.Sc. in Arts.

For an honors course the student must choose two subjects from the above and continue these throughout the two years. Both lectures and laboratory work will be required.

2.—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND B.Sc. IN APPLIED SCIENCE

(See page 77).

3.—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND M.D.

(See page 79).

4.—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND LL.B.

(See pages 80, 81).

FACULTY OF APPLIED SCIENCE

The University offers two groups of courses leading to the B.Sc. degree in Applied Science, one to the B.Sc. degree in Engineering (Civil, Electrical, Mining); the other to the B.Sc. degree in Architecture.

I—THE B.Sc. DEGREE IN ENGINEERING

The requirements of the first and second years of the three divisions of the Engineering groups are uniform, and are designed to give the general foundation in mathematics and physical science necessary to specialization in the various branches of Engineering in the last two years. In this group a course in French or German is also offered, specially adapted to an Applied Science curriculum. While this course is optional, students are advised to take it and credit toward general class standing will be given for work satisfactorily done therein.

Students of this University who may wish to study branches of Engineering in which the equipment for third and fourth year work has not been completed, may finish their course at certain universities of eastern Canada where, according to arrangement, they will be admitted *ad eundem statum.*

JUNIOR COURSES
FIRST YEAR

Subject	Course No	First half		Second half		Page
		Lect.	Lab.	Lect.	Lab.	
Algebra	Math.3	4		4		127
Anal. Geom.	Math 8			2		128
Geometry	Math.4	3				128
Mechanics	Math.6	2				128
Trigonometry	Math.5			3		128
Descr. Geom.	Draw.4		6		6	111
Drawing	2,3		6		6	111
English	1	3		3		114
†French or German	41	2		2		135
Physics	3,4and5	3	3	3	3	145
Practical Surveying	C.E.6					101

†Optional.

SECOND YEAR

Subject	Course No.	First half		Second half		Page
		Lect.	Lab.	Lect.	Lab.	
Calculus	Math. 9	3		3		128
Mechanics	Math.11	3		3		129
Chemistry	1	3	3	3	3	94
†French or German	42	2		2		135
Applied Statics	C.E. 1				6	100
Mapping	C.E. 2		6			100
Machine Drawing	Draw.5		3		3	112
Mat. of Constr.	C.E. 3			2		100
Mech. of Mach.	C.E. 4	2	1	2	1	101
Physics	6 and 7	2	3	2	3	145
Surveying	C.E. 5	2		2		101
Practical Surveying	C.E. 7					101

†Optional.

SENIOR COURSES

THIRD YEAR

Subject	Course No.	First half		Second half		Page
		Lect.	Lab.	Lect.	Lab.	
†Biology	Bot. 1	2	3			91
Framed Structures	C.E.53				6	102
Geodesy	C.E.54			3		102
Geology	52	2	3	2	3	117
Hydraulics	C.E.55	3		2		102
Mechanics	Math.54	2				130
Municipal Accounting	Acc.51			1		86
Practical Astronomy	C.E.60	2				104
Mapping	C.E.58		3			103
Structural Design	C.E.62	1		1	3	104
Testing Laboratory	C.E.65		3			105
Theory of Structures	C.E.67	2		3		105
Practical Surveying	C.E.64					104
Hydraulic Lab.	C.E.69				3	105

FOURTH YEAR

Subject	Course No	First half		Second half		Page
		Lect	Lab.	Lect.	Lab.	
†Advanced Structures	C.E. 51	2				102
†Bacteriology	Bact. 1			2	2	89
Electrical Engineering	E.E. 53	2		2		113
Foundations and Masonry	C.E. 52	1	3	1	3	102
†Hydraulic Machinery	C.E. 56	2				103
Mechanical Engineering	C.E. 57	2		2		103
Municipal Engineering	C.E. 59	3	3	3	3	103
Railway Engineering	C.E. 61	2		2		104
†Structural Design	C.E. 63	2	3	2	3	104
Testing Laboratory	C.E. 66		3		3	105
†Water Power Eng.	C.E. 68	1	1	1	1	105

†—Optional. In fourth year work three options are offered:

(a) Municipal option, comprising Botany 1; Bacteriology 1.

(b) Structural option, comprising Advanced Structures (C. E. 51); Structural Design (C. E. 63).

(c) Hydraulic option, comprising Hydraulic Machinery (C. E. 56); Water Power Engineering (C. E. 68).

SENIOR COURSES

B—ELECTRICAL ENGINEERING

The junior courses of the first two years are the same as those in the other engineering departments (see pp. 71, 72). The subjects of the third year are given below, and a statement will be made later as to fourth year work in this branch.

THIRD YEAR

Subject	Course No.	Lect. Hours	Lab. Hours	Page
Theory of Dir. Current	El.E 51	3		112
Direct Cur. Laboratory	El.E 52		6	112
Physics	53and54	2	6	146
Adv. Calc. and Sol. Anal. Geom.	Math.52	2		130
Mechanics	Math.54	2*		130
Theory of Structures	C.E. 67	2		105
Testing Laboratory	C.E. 65		3*	105
Mechanical Engineering	C.E. 57	2		103
Machine Design	El.E. 54	2		113
Mechanics of Machines	El.E. 55	2	1	113
Mechanical Drawing	El.E. 56		3	113

*First half session.

C—MINING ENGINEERING

THIRD YEAR

Subject	Course No.	First Half		Second Half		Page
		Lect.	Lab.	Lect.	Lab.	
Assaying	M.E. 54	1	3		3	132
Metallurgy	M.E. 55			2		132
Mining Engineering	M.E. 56	1		2		132
Ore Dressing	M.E. 52			2		131
Geology	Geol. 52	3	3	3	3	117
Geology	Geol. 54	2	3	1	3	118
Chemistry	Chem 55	3	6	3	6	97
Mechanics	Math.54	2				130
Theory of Struct.	C.E. 70			2		106
Testing Lab.	C.E. 65		3			105
Hydraulics	C.E. 55	3				102
Mine Survey School	M.E. 53					131

FOURTH YEAR

Subject	Course. No.	First Half		Second Half		Page
		Lect.	Lab.	Lect.	Lab.	
Metallurgy	M.E. 57	2		2		132
Mining Eng.	M.E. 58	3				132
Mining Machinery	M.E. 59			3		133
Mine Design	M.E. 60				3	133
Min. Colloquium	M.E. 62			1		133
Ore Dressing	M.E. 61	2				133
Clays and Clay Prod.	Geol. 59	1	3			120
Ore Deposits	Geol. 58	3		3	3	120
Petrology	Geol. 56	1	3			119
Petrography	Geol. 57			1	3	119
Mech. Eng.	C. E. 57	2		2		103
Elec. Eng.	El.En.53	2		2		113
Mineral Analyses	Chem.56		3		3	98
Geol. Colloquium	Geol. 60	1				120

II—THE B.Sc. DEGREE IN ARCHITECTURE

The courses of study in Architecture of the first year correspond generally with those in Engineering, but Architectural Drawing and History are introduced and French (courses 41 and 42) is obligatory. In the succeeding years the scientific and technical subjects are followed to the extent required in the practice of Architecture. History, especially in its social aspects, maintains a place in each year. Throughout the course increasing stress is placed upon the practice of architectural design.

JUNIOR COURSES

FIRST YEAR

Subject	Course No	Lecture Hours	Lab. Hours	Page
Architectural Drawing	Arch. 1		3	89
Descriptive Geometry	Draw. 4		6	111
English	1	3		114
Freehand Drawing	Draw. 3		6	111
French	41	2		135
History	1	3		122
Mathematics	1 and 2	4		127
Physics	3,4 and5	3	3	145
Practical Surveying	C.E. 6			101

SECOND YEAR

Subject	Course No	Lecture Hours	Lab. Hours	Page
Architectural Drawing	Arch. 2		3	90
Architectural Design	Arch. 3		6*, 9**	90
Algebra	Math. 3	4		127
Building Construction	Arch. 5		6	90
Decorative Arts	Arch. 6		4	90
French	42	2		135
Geometry	Math. 4	3*		128
History	2	3		123
History of Architecture	Arch. 4	2		90
Mapping	C. E. 2		3*	100
Trigonometry	Math. 5	3**		128

SENIOR COURSES

THIRD YEAR

Subject	Course No	Lecture Hours	Lab. Hours	Page
Graphical Statics	C. E. 71		6*	106
Architectural Drawing	Arch. 51		3	90
Architectural Design	52		9	90
Decorative Arts	Arch. 56		3	90
History	Hist. 53	3		123
History of Architecture	Arch. 54	2		90
Sanitation	Arch. 59	1**		90
Specifications	Arch. 58	1*		90
Testing Laboratory	C.E. 65		3**	105
Theory of Structures	C.E. 70	1	3	106

FOURTH YEAR

Subject	Course No	Lecture Hours	Lab. Hours	Page
Architectural Design	53	1	18	90
Decorative Arts	Arch. 57		3	90
History		3		
History of Architecture	Arch. 55	2		90
Municipal Engineering	C.E. 59	1**		103
Testing Laboratory	C.E. 66		3	105
Ventilation & Heating		1*		

*—First half session. **—Second half session.

III—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND B.Sc. IN APPLIED SCIENCE

I. English Composition.
History.
Mathematics (ordinary and *advanced sections)
Physics.
French, German, Latin or Greek, two; one of which must be a modern language. For students in Architecture French is obligatory.

II. English Literature.
†History.
The two languages taken in first year.
Descriptive Geometry (Drawing 4).
Freehand Drawing and Lettering (Drawing 2* and 3).

III. Economics (History 59).
Physics 3, 4 and 5.
Two senior subjects from Group A (p. 66).
**Architectural Drawing (Arch. 1).
*Mathematics 5 and 6.
Survey School (C. E. 6).

The subjects of years IV, V and VI are identical with those of years II, III and IV in the various groups of subjects in Applied Science.

FACULTY OF MEDICINE

I—THE M.D. DEGREE.

This degree is arranged on the basis of a five year curriculum of which the first three years' work is now offered.

Arrangements have been made by which any student who has completed the first three years of the curriculum for this degree in the University of Alberta may receive equivalent standing in McGill University or in the University of

†History 2 is required of all second year students in session 1915-16.
**Students in Architecture only.
*Omitted by students in Architecture.

Toronto, and may then proceed to the degree by completing the final two years of the medical curriculum in either of these Universities.

JUNIOR COURSES

FIRST YEAR

Subject	Course	First Half		Second Half		Page
		Lect.	Lab.	Lect.	Lab.	
Physics	Phys. 1 & 2	3	3	3	3	143
Botany	Bot. 2	3	3			91
Zoology	Zool. 1		3	3	6	93
Chemistry	Chem 2 & 3	6	6	6	6	94
French	Fr. 41	2		2		133

SECOND YEAR

Subject	Course	First half		Second half		Page
		Lect.	Lab.	Lect.	Lab.	
Gross Anatomy	Anat. 1	3	20			87
Gross Anatomy	Anat. 2			2	4	88
Histology	Anat. 10	2	4			88
Splanchnology	Anat. 12			2	4	88
Embryology	Anat. 14			1	2	88
Physiology	Physiol. 1			3	7	146
Biochemistry	Physiol. 2	3	4	3	7	146
Bacteriology	Bact. 1	1	2	1	2	89

SENIOR COURSES

THIRD YEAR

Subject	Course	First half		Second half		Page
		Lect.	Lab.	Lect.	Lab.	
Gross Anatomy	Anat53&54	3	15			88
Neurology	Anat. 60			3	6	89
Physiology	Physiol. 51	2	4	3	6	146
Clinical Physiology	Physiol. 52	1	3	1	3	147
Gen. Pathology	Path. 51	2	2	2	3	138
Bacteriology	Bact. 51		2		2	89
Path. Chemistry	Path. 52			1	2	138
Clin. Laboratory			2		2	29
Surgery	Surg. 51		2	1	2	147
Psychology	Psych. 53	1		1		142
Pharmacology	Pharm. 51			2		139

II—THE COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND M.D.

I. English Composition.
History.
Mathematics.
Physics.
French or German or Latin or Greek. (Two to be taken, of which one must be a modern language).

II. English Literature.
Chemistry I.
Botany 2.*
Zoology 1.*
The two languages taken in the first year.
*See page 66 for regulation concerning History 2.

III. Chemistry 52.
Three senior courses from Group A. (see p. 66).

IV. The subjects of second year Medicine.

The subjects of years V, VI and VII are identical with those of years III, IV and V in Medicine.

The B.A. degree may be granted at the end of the fourth year.

FACULTY OF LAW

UNDERGRADUATE DEGREES IN COURSE

I.—THE LL.B. DEGREE

In the Faculty of Law courses are offered leading to the degree of LL.B.

The course of study leading to the degree covers a period of four years. It is arranged to meet the requirements of the Alberta Law Society for students-at-law, providing along with these requirements such additional courses as are necessary to obtain the degree.

A special bulletin giving details of courses can be obtained on application to the Registrar.

II—COMBINED COURSE LEADING TO THE DEGREES OF B.A. AND LL.B.

I. 1. English Composition.
2. History.
3. Mathematics.
4. Physics.
5–6. *French.
*German.
*Greek.
*Latin.

*—Any two of these.

II. 1. English Literature.
2–3. *French.
*German.
*Greek.
*Latin.
†4. History.
5. Philosophy
or Biology
or Chemistry
or Mathematics
or Physics.

*—The two languages selected in first year.

†—History 2 is required of all second-year students in session 1915-16.

III. 1. History 58 (Can. Const. Hist.)
2. Economics.
3–4. Two Senior subjects from Group A. (See page 66).
5. One Senior subject from Group B. (See page 66).

IV.—1. History 57 (Eng. Con. Hist.)
Subjects of First Year Law—
Common Law
Equity

Contracts
Real Property
Can. Con. Law.

The subjects of years V and VI are identical with those of years II, III and IV in the LL.B. course.

The B.A. degree may be granted at the end of the fourth year.

The student should article with a lawyer at the end of the third year.

SCHOOL OF ACCOUNTANCY

THE DIPLOMA IN ACCOUNTANCY

The course leading to a Diploma in Accountancy is a two years' course covering the requirements for the Intermediate and Final examinations of the Institute of Chartered Accountants of Alberta, with additional courses in Mathematics and Economics. Students who wish to pass only the examinations of the Institute may omit these additional courses. Instruction in this department is offered in evening classes.

JUNIOR COURSES

FIRST YEAR

1. Law..... Acc. 1
2. Auditing..... Acc. 2
3. Theory and Practice of Acounting Acc. 3
4. Economics..... Hist. 3
5. Mathematics..... Math. 41

SECOND YEAR

1. Commercial Law..... Acc. 4
2. Auditing..... Acc. 5
3. Accounting..... Acc. 6
4. Economics..... Hist. 4
5. Mathematics..... Math. 42

SCHOOL OF PHARMACY

I. THE Phm.B. DEGREE.

II. THE LICENCING DIPLOMA.

The University offers two courses in Pharmacy, one, of only one session in duration, leading to the Licencing Diploma conferred by the Alberta Pharmaceutical Association; the other, of two sessions, to the Phm.B. degree.

FIRST YEAR.

Subject	Course No.	Lect. hrs.	Lab. hrs.	Page
*Physics	1 and 2	3	3	144
Chemistry	2 and 3	6	6	95
Botany	1			91
Pharmacy	1	2	4	126
Materia Medica	1	2		126
Pharmacology	2		2†	140
Toxicology	1	1†	2†	140
*Latin	A	3		105

*Compulsory for students proceeding to the Phm.B. degree, but optional otherwise.

†First half session.

SECOND YEAR.

The Practical Pharmacy is completed in the first year course. The subjects of Chemistry, Botany, Materia Medica, Physics and Pharmacology are studied in greater detail in their application to Pharmacy. A special course in Bacteriology is given to elucidate vaccines and sera preparations; to recognize the pathogenic and saprophytic bacteria and to include the subjects of antisepsis, asepsis, disinfection and sterilization.

DEGREES WITH DISTINCTION

I—FIRST CLASS STANDING

First Class Standing is awarded to those students in Applied Science and in the general course in Arts who have ob-

tained in the required senior courses an average of eighty-five per cent. or over.

II—DEGREES WITH HONORS IN THE FACULTY OF ARTS AND SCIENCES

The courses in honors differ from the general courses in that they are planned with a view to specialization, and are open only to students who have displayed ability in the junior courses. Students who have in the second year attained Class I in a subject are eligible to proceed to honors in that subject. Students who have attained Class II in a subject may, by permission of the Committee on Honors in consultation with the head of the department concerned, be allowed to proceed to honors. The third year must be entered without conditions in any subject. Students must begin their courses in honors in the third year, and in order to graduate with honors must continue through the third and fourth years.

GRADUATE, AD EUNDEM AND HONORARY DEGREES

I.—THE M.A. AND M.Sc. DEGREES

Candidates for higher degrees shall be under the supervision of the Committee on Graduate Studies.

1. A candidate for the Degree of Master of Arts or Master of Science must hold a Bachelor's degree from this University or be admitted *ad eundem gradum*, and before presenting himself for the higher degree must have held the Bachelor's degree for at least one academic year.

2. A candidate must proceed to the Master's degree by

(a) *the pursuit of a prescribed course of study.* This course of study shall consist of, or be equivalent to, a full year of advanced work, and must form a cohesive whole with a definite aim. The honors course in any subject running through two years, together with the associated ordinary courses, may be regarded as fulfilling this requirement,

or (b) *the carrying out of an investigation.* A candidate who elects to carry out a piece of original investigation shall submit on or before April 1st of the year in which the degree

is to be taken, a formal report embodying the results of the investigation, or submit a dissertation indicative of acquaintance with the methods of research, which shall be printed or typewritten, and which shall be deposited in the University Library. In all cases the subject of the investigation must receive the written approval of the head of the department concerned before it is submitted to the Committee on Graduate Studies as required in Section 3, and the report when completed shall be accepted only on the recommendation in writing of the department concerned. Every candidate will be required, in addition, to pass an examination written or oral, on the subject within which his investigation lies. Such examination shall be conducted under the supervision of the Committee on Graduate Studies.

3. A candidate must submit the course of study he proposes to follow, or the subject of the investigation he proposes to carry out, to the Committee on Graduate Studies, and receive its approval, on or before the first day of November preceding the spring in which the degree is to be taken. Candidates are strongly recommended, however, to submit their applications to the Committee at the close of the preceding session. This is especially advisable for students wishing to work in scientific departments.

II.—THE B.D. DEGREE

By an arrangement with the Affiliated Colleges the degree of B.D. is offered by the University to graduates in the Faculty of Arts and Sciences who follow a course of study presented by the affiliated colleges and approved by the University Senate.

III.—AD EUNDEM DEGREES

Applications for *ad eundem* **degrees,** accompanied by diplomas and a calendar of the institution conferring the degree, should be made to the Registrar.

IV.—HONORARY DEGREES

The degree of LL.D. is conferred in recognition of distinction in literature or science, or for notable public service.

Details of Courses by Departments

In all faculties courses of the first and second years are numbered 1-49; *senior courses,* 51-99; *honors and graduate courses, from* 101.

ACCOUNTANCY

Lecturer . . . . . Cecil Ethelbert Race, B.A., C.A.
Lecturer . . . . . William Wilson Gould, C.A.

Junior Courses.

1. Law.

Mercantile Law, Banking and Bills of Exchange, Partnerships and Companies.

Text Books: *Canadian Mercantile Law* (Anger); *The Bank Act* (Canada); *The Bills of Exchange Act* (Canada); *Partnership Ordinance* (Alberta); *Companies Ordinance* (Alberta); *Companies Act* (Canada).

Required of candidates for the intermediate examination of the Institute of Chartered Accountants.

2. Auditing.

An elementary course on the qualifications, duties and responsibilities of an auditor; conduct of simple audits.

Text Books: Dicksee, *Auditing* (Montgomery's edition); Spicer and Pegler, *Practical Auditing.*

Required of candidates for the intermediate examination of the Institute of Chartered Accountants.

3. Theory and Practice of Accounting.

The form, nature and classification of accounts; balance sheets; manufacturing, trading and profit and loss accounts; partnerships; joint stock companies; consignments; conversion of single entry into double entry; general book-keeping.

Text Books: Lisle, *Accounting in Theory and Practice* (Green and Sons); Hoskins, *Book-keeping for Joint Stock Companies;* Dicksee, *Book-keeping for Accountant Students.*

Required of candidates for the intermediate examination of the Institute of Chartered Accountants.

4. Law.

Companies, partnerships, executors, administrators, trustees, assignees, liquidators, commercial law, municipalities.

Text Books: Anger, *Canadian Mercantile Law; Companies Ordinance* (Alberta); *Partnership Ordinance* (Alberta); *Assignments Act* (Alberta); *Trustees and Executors Ordinance* (Alberta); *Companies Winding-up Ordinance* (Alberta); *Village Act* (Alberta); *Towns Act* (Alberta).

Required of candidates for the final examinations of the Institute of Chartered Accountants.

5. Auditing. Advanced Course.

The procedure and duties of an auditor in the conduct of an audit of all classes of accounts; certificates and reports; legal decisions affecting auditors.

Text Books: Montgomery, *Auditing—Theory and Practice* (Ronald); Pixley, *Auditors' Duties and Responsibilities.*

Required of candidates for the final examinations of the Institute of Chartered Accountants.

6. Advanced Accounting.

Partnership settlements, company accounts, cost accounts and the accounts of executors, administrators, assignees and liquidators, municipal accounts.

Text Books: Hawkins, *Cost Accounts*; MacPherson, *Municipal Accounting.*

Reference works: Nicholson, *Factory Organization and Costs;* Keister, *Corporation Accounting and Auditing.*

Required of candidates for the final examinations of the Institute of Chartered Accountants.

51. Municipal Accounting.

The issue and redemption of debentures; capital and revenue expenditures; books of record and of account; vouch-

ers, systems, costs, comparative statements and balance sheets; the statutes of the province relating to cities, towns, villages and rural municipalities.

Text Books: MacPherson, *Municipal Accounting* (The Bookkeeper Publishing Company); *A Handbook of Municipal Accounting* (Appleton); *The Statutes of Alberta.*

Required of third year students in Civil and Municipal Engineering.

DEPARTMENT OF ANATOMY

Professor . . . . . Daniel Graisberry Revell, B.A., M.B.
Lecturer . . . . . .
Demonstrators (1914-15) . . . . Gordon Cameron Gray, M.B.
Leighton Carling Conn, M.D., C.M.

During the session of 1915-16 courses in Anatomy are offered in the second and third years of the five year curriculum. The general aim in the work is to give the student a clear and concrete knowledge of the structure of the living body. A good supply of well-preserved material for dissection is available. Microscopes and accessories are provided for each student in the courses in minute anatomy.

Second year.

During the first half of this year the student dissects the thorax and abdomen preparatory to the work in Physiology. During the second half the dissection of the extremities is finished.

1. Gross Anatomy of Thorax and Abdomen,
3 hrs. lect., 20 hrs. lab., first half.

Text Book: Cunningham, Gray, Morris (American Edition), Piersol, Quain.

Practical Manual: Cunningham.

For reference: Spalteholz, *Hand-atlas of Human Anatomy* (translated by Barker); Toldt, *Atlas of Human Anatomy;* Sobotta & McMurrich, *Atlas and Text Book of Human Anatomy;* Eycleshymer and Shoemaker, *Atlas of Cross-Sections;* Von Bar-

deleben, *Handbuch der Anatomie;* Poirier et Charpy, *Traité d'Anatomie;* Barker, *Anatomical Terminology;* Medical Dictionary by Stedman, Gould or Dorland.

2. Gross Anatomy of Upper and Lower Extremities.
2 hrs. lect. and 4 hrs. lab., second half.

Text Books as for Course 1.

10. Histology. 2 hrs. lect., 4 hrs. lab., first half.

A course in cytology and histology, comprising lectures and practical work.

Text Books: Stöhr (American edition), Bailey, Schäfer, Böhm & Davidoff, Ferguson, Quain (Vol. 2, Pt. 1).

For reference: Sobotta, *Atlas of Human Histology.*

12. Splanchnology. 2 hrs. lect.; 4 hrs .lab., second half.

This course deals with the minute and general structure of the organs.

Text Books as for Course 1.

14. Embryology. 1 hr. lect., 2 hrs. lab., second half.

A course in vertebrate embryology, studied by means of chick, frog, pig and human material and by models.

Text Books: Reese, McMurrich, Quain, (Vol. 1) Lillie, Minot.

Third Year.

53. Gross Anatomy of Head and Neck.
3 hrs. lect., 15 hrs. lab., first half.

The study of these parts is made preliminary to the course in Neurology.

Text Books as for Course 1.

54. Systematic Gross Anatomy. Second half.

At the end of the third year a practical ond written examination is given on the gross anatomy of the whole body.

56. Advanced Gross Anatomy.

This course is offered to students who have finished the

required work and wish to do additional and special work in Anatomy.

60. Neurology. 3 hrs. lect., 6 hrs. lab., second half.

A study of the gross and minute anatomy of the nervous system and of the organs of the special senses.

Text Books: Villiger, Johnston, Barker, Sherrington.

ASTRONOMY

(See Department of Mathematics)

DEPARTMENT OF BACTERIOLOGY

Professor .... Allan Rankin, M.D., C.M., D.P.H.
Acting Professor..Heber C. Jamieson, M.B.,M.R.C.S.,L.R.C.P.

Junior Course.

1. Elementary Bacteriology. 3 hrs. lect., 3 hrs. lab.

The making of media; staining and cultivation of pathogenic micro-organisms.

Required of students in the second year of Medicine, and (for the first half-session only) of students taking the municipal option in Civil Engineering.

Senior Course.

51. 2 hrs. lect. and lab.

The identification of special bacteria, and the relationship of bacteria to disease.

DEPARTMENT OF ARCHITECTURE

Professor .... Cecil Scott Burgess, A.R.I.B.A.
Assistant Professor of Drawing .... James Adam, M.A.

Junior Courses.

1. Architectural Drawing. 3 hrs. lab.

Geometrical drawing of traditional architectural forms. Required of first year students.

2. Architectural Drawing. 3 hrs. lab.

Study of historical examples by means of drawing.

3. Architectural Design. 6 hrs. lab.

Traditional forms and their application.

4. History of Architecture. 2 hrs. lab.

Ancient, classical, Byzantine.

5. Building Construction. 6 hrs. lab.

Methods of employing, assembling and framing materials.

6. Decorative Arts. 4 hrs.

The crafts contributory to architecture ,masonry, joinery, furniture, carving, wrought-iron, plaster work.

Courses 2-6 required of second year students.

Senior Courses.

51. Architectural Drawing.

Various methods of rendering architectural subjects.

52. Architectural Design. 9 hrs. lab.

Problems in plans and elevation.

53. Architectural Design. 18 hrs. lab.

Planning and grouping.

54. History of Architecture. 2 hrs. lab.

Romanesque, medieval.

55. History of Architecture. 2 hrs.

Renaissance, modern.

56. Decorative Arts. 3 hrs.

57. Decorative Arts 3 hrs.

58. Specifications. 1 hr., sec. half.

59. Hygiene and Sanitation. 1 hr., sec .half.

DEPARTMENT OF BIOLOGY

Professor . . Francis John Lewis, D.Sc., F.R.S., (Edin.), F.L.S.
Lecturer in Zoology . . . . . .
Student-Assistant in Botany . . Gwynethe Marie Tuttle, B.A.

The work of the department is divided into two branches Botany and Zoology.

The courses in Botany are designed as a training for students in the faculty of Arts and Sciences, agricultural students and medical students. The courses in Zoology are designed chiefly for medical students and for such others as offer themselves in the faculty of Arts and Sciences.

BOTANY

1. General Elementary Botany. 2 hrs. lect., 3 hrs. lab.

This course is intended as a foundation for all senior courses in the department. Structure and physiology of the cell; outlines of the anatomy and comparative morphology of representative types of plants ;the biological relationships of the lower groupss of plants and animals; elementary plant physiology.

Text Books: P. Groom, *Elementary Botany* (G. Bell, Ltd.); Francis Darwin, *Elements of Botany* (Camb. Univ. Press). Harvy Gibson, *Biology* (Dent & Co.).

2. General Elementary Botany (Medical)
2 hrs. lect., 3 hrs. lab., first half.

This course is designed for medical students only and will consist in the main of the same work as Botany 1.

51. Comparative Anatomy and Morpnology.
2 hrs. lect., 4 hrs. lab.

Study of the anatomy and morphology of the principal groups of plants ;palaeobotany; general principles of classification.

Text Books: Strasburger, *Text Book of Botany* (Macmil-

lan); D. H. Scott, *Fossil Botany*, 2 Vols. (Macmillan); Campbell, *Mosses and Ferns* (Macmillan).

Open to third and fourth year students in Arts.

52. Plant Physiology and Ecology. 2 hrs. lect., 4 hrs. lab.

The factors affecting plant growth and distribution, plant formations and associations, representative plant associations of North America and their relation to soil and climate.

Text Books: Schimper, *Plant Geography* (Clarendon Press) Warming, *Plant Ecology* (Clarendon Press); Hall, *The Soil* (Murray); Jost, *Plant Physiology* (Clarendon Press); Detmer-Moor, *Practical Plant Physiology* (Allen); Darwin and Acton, *Physiology of Plants* (Camb. Univ. Press).

Open to fourth year students in Arts.

53. Agricultural Botany. 2 hrs. lect., 4 hrs. lab.

The practical application of Botany to Agriculture and allied industries will be kept clearly in view and especial attention will be paid to useful and harmful plants.

Physiology of plant nutrition; mycorhiza; influence of environment on the nutrition of plants; distribution of seeds of weeds and parasites; injuries and diseases of plants; new varieties and possibilities of developing improved forms; systematic study and principles of classification.

Text Books: Percival, *Agricultural Botany* (Duckworth); Hugo De Vries, *Plant Breeding* (Kegan Paul Trench Trübner).

Open to third and fourth year students in Arts.

54. Forestry. 3 hrs.

In addition to the usual lectures, classes will be held from time to time to demonstrate certain subjects dealt with in the lectures.

Distribution of forests; relative climatic conditions of grassland and forest; situation and aspect; forest soils; succession of forests; forest formations and associations; diseases of living trees and of timber.

Open to third and fourth year students in Arts.

55. Biochemistry. 2 hrs. lect., 3 hrs. lab., second half.

Physiology, chemistry and growth of the cell; selective action of protoplasm; the results of bio-chemical stimulation by inorganic and organic bodies; the biochemistry of cell products; carbohydrates, fats, proteins, lecithides, enzymes and enzyme action; fermentation ;protoplasm and osmotic phenomena; chemotaxis.

This course is designed for all students pursuing biological courses beyond the junior stage. It is particularly desirable that students taking Course 52 (Plant Physiology and Ecology) should also take this course.

Honors Courses.

101. Palaeobotany.

The evolution of modern groups of plants as illustrated by the structure of fossil types from various geological horizons.

102. Comparative Anatomy and Ecology.

The evolution of the different tissues of plants treated from a comparative point of view.

103. Comparative Physiology and Ecology.

The functions of plant organs treated from a comparative point of view; the relation of vegetation to habitat; plant associations and formations; their distribution in time and space.

Graduate Courses.

Special courses of higher study in some department of botany, leading to the master's degree will be arranged in conference with the head of the department, and facilities for original investigation will be given to those graduates who wish to take the master's degree.

ZOOLOGY

1. 2 hrs. lect., 3 hrs. lab., second half.

This course is designed for first year Medical students and forms an introduction to the senior coursses in the subject.

The anatomy, elementary physiology and histology of the various systems of organs in the frog; structure of the various elementary tissues of the frog; the combination of tissues to form organs; living and non-living matter. Structure, habits and life histories of the following typical animals viewed from a comparative standpoint: *Amoeba*, *Paramoecium*, *Vorticella*, *Hydra*, *Lumbricus*. (the earthworm), *Astacus*, (the crayfish); *Scyllium*, (the dogfish), and *lepus*, (the rabbit).

The concluding lectures of the course will deal with the phenomena of reproduction; asexual and sexual reproduction; ova and spermatozoa; spermatogenesis; fertilization and segmentation of the ovum in Amphioxus and Rana; the development and larval history of the frog.

Senior courses in Zoology will be arranged on application to the Professor.

DEPARTMENT OF CHEMISTRY

Professor . . Adolf Ludwig Ferdinand Lehmann, B.S.A., Ph.D.
Lecturer . . . . . Alfred Denys Cowper, B.Sc.
Lecturer . . . . . .

Junior Courses.

1. Elementary General Chemistry. 3 hrs. lect., 3 hrs. lab.

Lectures: A study of the most important non-metals, together with a few of the metals; outline of the laws and theories of chemistry, and occasional references to the chemical industries and the history of chemistry.

Text Books: (1) Alexander Smith, *General Chemistry for Colleges* (Century Co.); (2) Oscroft, *Advanced Inorganic Chemistry* (Bell and Sons).

Required of second year students in Engineering; open to second year students in Arts and Sciences.

Laboratory work: The setting up of apparatus; glass blowing; use of the chemical balance; quantitative preparation and separation of a few substances to illustrate some of the fundamental laws of chemistry; introduction to qualitative chemical analysis.

Text Books: (1) Kenrick and De Lury, *Elementary Laboratory Course* (Macmillan); (2) Noyes, *Qualitative Chemistry* (Holt); (3) Laboratory Notes.

2. Elementary General Chemistry. 6 hrs. lect., first half, 6 hrs. lab.

Lectures: As in Chemistry 1.

Laboratory work: (1) The preparation of a few inorganic substances, illustrating some fundamental principles of chemistry, particularly combining weights.

(2) Introduction to qualitative chemistry. A study of the methods employed; separation of the groups and a study of the metals of the first two groups.

(3) Volumetric and gravimetric analysis; standardizing of apparatus; alkalimetry; preparation of normal and standard solutions; determination of sugar, iodine, iron, chlorine, lime, phosphoric acid; analysis of bleaching powder.

Text Books: (1) Kenrick and De Lury, *Elementary Laboratory Course* (Macmillan); (2) Noyes, *Qualitative Analysis* (Holt); (3) Laboratory Notes.

Required of first year students in Medicine and Pharmacy.

3. Elementary Organic Chemistry. 6 hrs. lect., sec. half.

Aliphatic and aromatic series.

Text Book: Ira Remsen, *Organic Chemistry* (Heath).

Laboratory work: (1) Preparation of some organic compounds.

Required of first year students in Medicine and Pharmacy.

Senior Courses.

51. General Chemistry. 3 hrs. lect., 3 hrs. lab.

Lectures: (1) Inorganic Chemistry (42 hours) in continuation of Chemistry 1.

Text Book: Holleman, *Inorganic Chemistry* (Wiley).

(2) Physical Chemistry (28 hrs.) A general outline: stoichiometry; the gas laws ;relations between physical and

chemical properties of stubstances; osmotic pressure and the theories of solutions; thermochemistry; elementary electrochemistry; chemical dynamics and phase rule.

Text Book: Jones, *Introduction to Physical Chemistry* (Macmillan.)

(3) Analytical Chemistry (14 hours). A general outline of the principles on which analytical chemistry is based.

Laboratory work: (1) Qualitative Chemical Analysis; a continuation of the course in Chemistry 1, including the identification of all the common bases and acids.

Text Book: Noyes, *Qualitative Analysis* (Holt).

(2) Volumetric and Gravimetric Qualitative Analyses, standardization of weights and measures, alkalimetry, preparation of normal solutions; determination of total and free chlorine, sulphuric acid, iron, phosphoric acid, fats, sugar, and carbonic acid in pure substances and in natural or commercial products.

(3) Physical Chemistry. Determination of a series of physical constants of several chemical substances; practical stoichiometry ;typical experiments in thermochemistry; chemical dynamics and equilibrium.

Open to third and fourth years students in Arts.

52. Elementary Organic Chemistry. 3 hrs.lect., 3 hrs. lab.

Lectures: Both aliphatic and aromatic series. A study of a few of the best known members of the most important groups of compounds, illustrating general properties, molecular structure and synthetic preparation.

Text Book: Ira Remsen, *Organic Chemistry* (Heath).

Laboratory work: (1) Preparation and study of properties of some organic compounds.

Text Book :Garrett and Harden, *Practical Organic Chemistry* (Longmans Green).

(2) Identification and ultimate analysis of organic substances.

(3) Continuation of the work of Chemistry 51 in quantitative analysis.

Open to third and fourth year students in Arts.

53. Agricultural Chemistry. 3 hrs. lect., 3 hrs. lab.

The function of the agricultural chemist, his methods of investigation, history of experiment stations; the formation, composition and mechanical condition of the soil; the function and regulation of soil water; the properties of humus, its formation and decomposition; fixation of nitrogen, nitrification and denitrification; the use, composition and source of fertilizers; their retention by the soil; the changes in composition taking place in crops during growth and preservation; the composition, feeding-value and source of fodders; nutrition of farm animals, changes in composition during growth and fattening; the chemistry of dairy products.

Text Books: (1) Hart and Jottingham, *General Agricultural Chemistry*; (2) Hilyard, *Soil* (Macmillan); (3) Kellner, *Scientific Feeding of Animals* (Macmillan).

Open to third and fourth year students in Arts. .

54. Advanced General Chemistry. 3 hrs. lect., 3 hrs. lab.

Lectures :(1) Advanced Inorganic Chemistry, in continuation of Chemistry 51.

(2) Advanced Physical and Electrochemistry, in continuation of Chemistry 51. Electrochemical theories; laws and units; migration of ions; conductivity; electromotive force, thermodynamic and Nernst theories; concentration cells; single potential; electrolysis and polarization; theory of accumulator.

Laboratory work: (1) Quantitative Chemical Analysis, in continuation of Chemistry 51.

(2) Practical Physical Chemistry.

Open to third and fourth year students in Arts.

55. General Chemistry. 3 hrs. lect., 6 hrs. lab.

Lectures as in 51.

Laboratory work: (1) Qualitative Chemical Analysis. Continuation of course in Chemistry I.

Text Book: Noyes, *Qualitative Analysis* (Holt.)

(2) Volumetric and Gravimetric Analysis; with a special view to preparing the candidate for mineral analysis.

Standardization of weights and measures. Volumetric work; acidimetry and alkalimetry; determination of iron and chlorine. Gravimetric work; determination of manganese; aluminium; calcium; magnesium; copper; potassium; sodium; chlorine, sulphuric acid; phosphoric acid; and silicic acid.

Text Book: Foulk, *Notes on Quantitative Chemical Analysis* (McGraw-Hill Book Co.).

Required of third year students in Mining Engineering.

56. Mineral Analysis. 3 hrs. lab.

Analysis of ores and minerals, including the proximate analysis and calorific value of coals.

Text Book; Lord and Demorest, *Metallurgical Analysis* (McGraw-Hill Book Co.).

Required of fourth year students in Mining Engineering.

Honors Courses.

101. Advanced Organic Chemistry. 3 hrs. lect., 6 hrs. lab.

Lectures: Aliphatic Series.

Text Book: Holleman, *Organic Chemistry* (Wiley).

Laboratory Work: (1) Preparation of organic substances.

Text Book: Garrett and Harden, *Practical Organic Chemistry* (Longmans, Green).

(2) Quantitative analysis of organic substances.

102. Advanced Chemistry. 3 hrs. lect., 6 hrs. lab.

Lectures: (1) Organic Chemistry, Aromatic Series (2 hrs.)

Text Book: Holleman, *Organic Chemistry* (Wiley.)

(2) History of Chemistry. (1 hr.).

Text Book: Meyer, *History of Chemistry* (Macmillan).

Laboratory work: (1) Continuation of preparation of organic substances.

(2) Electrochemistry. Conductivity; molecular conductivity and Ostwald's law; temperature coefficient; application to analysis; transport numbers. Electromotive force; stan-

dard cells; measurement of E.M.F.; concentration cells; single potential; decomposition potential; thermo-element; electro-analysis. Dielectric constant.

DEPARTMENT OF CIVIL AND MUNICIPAL ENGINEERING

Professor . . . . . William Muir Edwards, M.Sc.
Assistant-Professor of Mechanical Engineering
Charles Alexander Robb, S.M.
Lecturer in Structural Engineering
Ibrahim Follansbee Morrison, S.B.
Lecturer in Surveying and Geodesy
Walter Maxwell Fife, B.Sc.

Junior Courses.

1. Applied Statics. 6 hrs. lab., sec. half.

Composition and resolution of forces; determination of reaction; stresses in framed structures; centres of gravity; moments of inertia; shears and bending moments by graphical and analytical methods.

Required of second year students in Engineering.

2. Mapping. 6 hrs. lab., first half.

Preparation of maps from notes taken in Survey Field Work, C. E. 6; methods of checking work; computation of areas; study of contour maps and solution of problems in road location, etc.; mine surveys; methods of topographical drawing.

Required of second year students in Applied Science.

3. Materials of Construction. 2 hrs., sec. half.

This course deals with the manufacture, physical characteristics and standard tests of materials used in construction, such as clay and its products; cement; concrete, plain and reinforced; cast iron; wrought iron; steel; stone: timber. When possible, visits are made to see the production and use of these materials.

Text Book: J. B. Johnson, *Materials of Construction, Surveying, Vol* 1. (Wiley).

Required of second year students in Engineering.

4. Mechanics of Machines. 2 hrs. lect., 1 hr. lab.

Discussion of the principles involved in the simpler machines; constrained motion; velocity and acceleration in mechanisms; analysis and classification of the simpler machines; gears and gear trains.

Text Book: Schwamb and Merrill, *Elements of Mechanism.* (Wiley).

Required of second year students in Engineering.

5. Surveying. 2 hrs.

Construction, adjustments, use and limitations of chain, compass, level, transit, plane-table and sextant; surveying methods of computations; topography; contours; general Land Systems of Dominion and Province; descriptions of land for deeds; photographic surveying; underground surveying; elementary astronomy; methods of triangulation.

Text Book: Breed and Hosmer, *Principles and Practice of Surveying, Vol.* 1. (Wiley). Cautley, *Descriptions of Land,* (Macmillan).

Required of second year students in Engineering.

6. Elementary Practical Surveying.

Field work, including chaining, rodding, chain surveys, compass surveys and practice with the level and transit.

Required of first year students in Engineering and Architecture.

7. Practical Surveying.

Field work including practice with the level and transit, adjustments of the instruments; the survey and location of a railroad line with determination of topography, and curves; slope-staking; an elementary course in practical astronomy.

These courses in practical surveying are held during the latter part of April, the final examinations being finished before the school opens. Outside work will be done during the

day and in the evening notes will be reduced and checked and the necessary plotting done. The field notes will provide data required for mapping in the second and third year work. Work will be carried on with the University as a base, office work being done there, and the field work in the adjacent districts.

Senior Courses. *

51. Advanced Structures. 2 hrs., first half.

A course in the principle of least work as applied to indeterminate structures; deflections of trusses and girders; theory of arches and skeleton frame buildings. (Required only of students taking the structural option).

52. Foundations and Masonry. 1 hr. lect., 3 hrs. lab.

Theory and design of bridge piers and abutments; masonry dams and retaining walls; masonry arches; bearing power of soils; piles; footings; grillages; under-pinning; foundations under water; coffer dams, etc.

53. Framed Structures. 6 hrs. lab., sec. half.

Moving loads on bridges; influence lines; stresses in various forms of trusses, bridges and trestles; reactions for metal arches and cantilevers, etc.

54. Geodesy. 3 hrs., sec. half.

Theory of Least Squares; figure of the Earth; measurement of base lines; triangulation; adjustment of observations; map projections.

55. Hydraulics. Lecture course.
3 hrs. first half, 2 hrs. sec. half.

The fundamental principles of Hydraulics considered and applied to problems on discharge under various conditions through orifices, notches, weirs, pipes and open chan-

*Courses 53, 54, 55, 58, 60, 62, 64, 65, 67, 69 are required of third year students in Civil Engineering; courses 51, 52, 56, 57, 59, 61, 63, 66, 86 of fourth year students in Civil Engineering; courses 57, 65, 67 of third year students in Electrical Engineering; courses 55, 65, 70 of third year students in Mining Engineering; course 57 of fourth year students in Mining Engineering; courses 65, 70, 71 of third year students in Architecture; and courses 59, 66 of fourth year students in Architecture.

nels; theory of impact of jets and its application to turbine design; centrifugal pumps.

56. Hydraulic Machinery. 2 hrs., first half.

Application of the principles of Hydraulics in the design of turbines and centrifugal pumps; transmission of power by hydraulic pressure and the functions of the accumulator; influence of inertia forces in the operation of reciprocating motors, pumps, riveters, etc.

Required only of students taking the Hydraulic Engineering option.

57. Mechanical Engineering. 2 hrs.

A general course dealing with power plants; boiler plants and accessories; principles governing selection; the steam engine; estimation of power developed; condensers; pumps and accessories; principles of design in steam plants; gas engines and gas producing plants; location and design of power installations.

58. Mapping. 3 hrs. lab., first half.

Preparation of maps, plans, sections, estimates, etc., from notes taken in C. E. 7.

59. Municipal Engineering. 3 hrs. lect., 3 hrs lab.

(1) Sewerage and Sewage disposal. The various systems for removal of sewage; special methods in use for its treatment and ultimate disposal; the construction and design of main, branch, and intercepting sewers; details of construction and operation. The design of a system for a small town will be required of all students.

Text Book: Folwell, *Sewerage.* (Wiley).

(2) Water supply and water purification. Quantity and quality required; rain-fall, evaporation, and run-off from a water-shed; storage; combined and separate fire and domestic systems; works for, and details in connection with the storage and supply to the user; purification. The design of a supply for a small town will be required of all students.

Text Book: Merriman, *Public Water Supplies.* (Wiley).

(3) Roads and Pavements; construction; materials; specifications; standard sections; cost data.

60. Practical Astronomy. 2 hrs., first half.

The systems of time; the theory of observations for time, azimuth, latitude and longitude.

Text Book: Hosmer, *Practical Astronomy.* (Wiley).

61. Railroad Engineering. 2 hrs.

Compound, transition, vertical and turn-out curves; earthwork; cost of railroad construction; cost of operation; effect of distance, grade and curvature on operating expenses; reconnaissance, preliminary and location surveys; details of construction; yards, terminals, etc.

Text Book: Allen, *Railroad Curves and Earth-work.* (Spon and Chamberlain). Webb, *Railroad Construction.* (Wiley).

62. Structural Design. 1 hr. lect., first half, 1 hr. lect., sec. half, 3 hrs. lab., sec. half.

General descriptive course including uses of engineering materials, specifications, etc.; design of a wooden roof truss with simple details and connections in steel; design of a plate girder bridge.

Text Book: Thayer, *Structural Design.* (Van Nostrand).

63. Structural Design.

(a) 2 hrs. lect., 3 hrs. lab., first half.

General lectures in bridge engineering and plate girder design; detailing of the plate girder started in C. E. 62.

(b) 2 hrs. lect., 3 hrs. lab., sec. half.

Lectures on the design of certain members of trusses and details of bridge joints; high office buildings; reinforced concrete.

64. Advanced Practical Surveying.

(a) Hydrographic survey of a river channel and measurements of discharge.

(b) Astronomical observations for time, latitude, azimuth and longitude.

(c) Geodetic surveying,—base line measurement and triangulation.

(d) Methods of underground surveying.

This course will be held with courses 6 and 7 in April, except for (a) which will be held in the fall.

65. Testing Laboratory. 3 hrs. lab., first half.

Tests are carried on to illustrate the principles of the lecture course in Theory of Structures and to determine the physical characteristics of the materials of construction. The tests include tension and compression tests in the 75-ton testing machine, determination of stress-strain diagrams by extensometers and scales; deflection of beams; deflection and vibration of spiral springs; torsional oscillation of wires; determination of Young's Modulus for various materials; complete tests of cement; efficiency of chain blocks, etc.

66. Testing Laboratory, 3 hrs. lab.

A more advanced course in the testing laboratory; standard testing of brick, stone, cement, etc.; the manufacture and testing of reinforced concrete beams.

67. Theory of Structures. 2 hrs., first half, 3 hrs., sec. half.

The theory of stress, strain and resilience for homogeneous elastic materials; compound members; the theory of straight and curved beams; reactions of continuous girders; columns; shafting; springs; hooks, etc.; compound stresses; theory of reinforced concrete; thick cylinders and flat plates.

68. Water Power Engineering. 1 hr. lect., 1 hr. lab.

Rainfall, evaporation and run-off; collection, storage and use of water for various purposes; velocity and discharge measurements; power development, construction and costs.

69. Hydraulic Laboratory. 3 hrs. lab., sec. half.

Tests are carried on to illustrate the principles in the lecture course on Hydraulics.

70. Theory of Structures. (Architecture and Mining). 2 hrs., sec. half.

Definitions, distributed forces, beam theory, deflection of simple beams, columns, principles of reinforced concrete.

71. Applied Statics. (Architecture). 3 hrs. lab., first half.

Composition and resolution of forces (graphically and analytically); determination of reactions; definitions, etc., of moments; stresses in simple roof trusses; bending moment and shearing force curves; retaining walls, arches and vaults.

DEPARTMENT OF CLASSICS

Professor ..... William Hardy Alexander, M.A., Ph.D.
Assistant Professor of Greek
William Dudley Woodhead, M.A.
Assistant Professor of Latin .. Geneva Misener, M.A., Ph.D.

In the Junior Courses the amount of assigned reading is comparatively small, the aim being that the student through intimate acquaintance with a few standard texts may develop some practical command over the vocabulary and idiom of Latin and Greek. With the same object in view much attention is paid to prose composition also.

In the Senior Courses the amount of assigned reading is materially increased. The purpose in these courses is that the student may obtain through the original literatures some conception of the thought and life of the ancient Mediterranean world.

Attention is drawn to the fact that in the Junior Courses the authors and the prose composition constitute distinct branches of the work which must be separately passed.

LATIN

A and B.

An introductory course extending over two years for students entering the University with a condition in Latin. This cannot be credited towards a degree and is planned

simply to enable students to make up deficiencies in matriculation.

A. Introductory Latin. 3 hrs.

The forms of the Latin language and the rudiments of its syntax. The text is *Limen* (Walters and Conway: Murray).

B. Matriculation Latin. 3 hrs.

The reading of selections from standard authors of the classical period. For 1915-16 the authors are: Nepos, *Lives of Mitrades, Themistocles, Aristides, Pausanias* (Roberts: Ginn); Vergil, *Aeneid II* (Sandford: Blackie).

The study of syntax is continued in the form of Latin prose composition. The text is Bennett's *Preparatory Latin Writer* (Allyn and Bacon).

Junior Courses.

1. Cicero: Horace. 2 hrs.

Cicero, *De Amicitia* (Shuckburgh: Macmillan);
Horace, *Odes I and II* (Moore: A. B. Co.)

3. First Year Latin Composition. 1 hr.

A systematic study of the main principles of Latin syntax as applied to composition. Students will provide themselves with a Latin grammar (Allen and Greenough: Ginn) and Bennett's *Latin Composition* (Allyn and Bacon).

Course 3 constitutes in combination with course 1 the Latin requirement of the first year.

2. Sallust: Vergil. 2 hrs.

Sallust, *Catiline and Jugurtha* (Capes: Clarendon Press): Vergil, *Aeneid VI* (Cotterill: Blackie) and *Selections, Aeneid X to XII* (Papillon and Haigh: Clarendon Press).

4. Second Year Latin Composition.

Exercises in continuous Latin prose composition. Students will require a grammar (see Latin 3), and will also provide themselves with Nutting's *Advanced Latin Composition*

(Allyn and Bacon), and an English-Latin lexicon (White: Longmans).

Course 4 constitutes in combination with course 2 the Latin requirement of the second year.

Senior Courses.

51. Cicero, the Letters: Lucretius. 3 hrs.

Course A in the literature of the Republic. Cicero, *Letters* (Abbott: Ginn); Lucretius, *De Rerum Natura I, III* (Lee: Macmillan), *V*, 783-1457 (Lowe: Clarendon Press). A Latin prose version in each month of the college year.

(Not given in 1915-1916).

52. Tacitus, Annals; Juvenal. 3 hrs.

Course A in the literature of the Empire. Tacitus, *Annals I-IV;* Juvenal, *Select Satires.* A Latin prose version in each month of the college year.

(Not given in 1915-1916).

53. Seneca, Epistles; Martial. 3 hrs.

Course B in the literature of the Empire. Seneca, *Select Letters* (Summers: Macmillan), *ad Polybium de Consolatione* (Ball: Macmillan); Martial, *Select Epigrams* (Bridge and Lake: Clarendon Press). A Latin prose version in each month of the college year.

Honors and Graduate Courses.

101. Propertius. 2 hrs.

A critical study of selected portions of the text with private reading of the Elegies entire.

(Not given in 1915-1916).

102. Plautus. 2 hrs.

Special studies in text-criticism and in the history of the Latin language, based for the current year on the *Rudens* and the *Trinummus.* Other plays will be assigned for private reading.

111. Latin Syntax. 1 hr.

Detailed studies of special points in Latin syntax. For the current year attention will be concentrated on certain phases of the syntax of the verb.

112. Roman Private Life. 1 hr.

A series of lectures on Roman private life, accompanied by a course of parallel reading in the chief authorities.

(Not given in 1915-1916).

GREEK

A and B.

An introductory course extending over two years; it cannot be credited towards a degree.

A. Introductory Greek. 3 hrs.

The forms of the Greek language and the rudiments of its syntax. The texts are: *Greek Grammar* (Bryant and Lake: Clarendon Press), *Greek Syntax* (Bevier: A. B. Co.), *Greek Reader* (Colson: Macmillan).

B. Matriculation Greek. 3 hrs.

The reading of selections from Greek authors; for the current year these are *Tales from Herodotus* (Farnell: Macmillan): Homer, *Odyssey VI* (Bain: Ginn).

The study of syntax is continued and applied to prose composition; the text is Pitman's *Greek Prose Composition* (Macmillan).

Junior Courses.

1. Lysias: Homer's Odyssey. 3 hrs.

Lysias, *Regarding the Olive Stump, On Behalf of the Cripple, Against the Grain-dealers* (Shuckburgh: Macmillan); Homer, *Odyssey IX* (Merry: Clarendon Press).

3. First Year Greek Composition. 1 hr.

A systematic study of some outstanding principles of Greek syntax as applied to composition. Students will pro-

vide themselves with Thompson's *Elementary Greek Grammar* (Murray) and Pitman's *Greek Prose Composition* (Macmillan).

Course 3 constitutes in combination with course 1 the Greek requirement of the first year.

2. Plato; Euripides. 2 hrs.

Plato, *Apology* (Williamson: Macmillan) and *Crito* (Owen: Blackie); Euripides, *Hippolytus* (Harry: Ginn).

4. Second Year Greek Composition. 1 hr.

Exercises in review of the work in course 3; exercises in paragraph composition. Texts as in 3.

Senior Courses.

51. Thucydides; Greek Tragedy. 3 hrs.

Thucydides VII (Marchant: Macmillan); *Aeschylus*, one play; *Sophocles*, one play.

(Not given in 1915-1916).

52. Demosthenes: Aristophanes. 3 hrs.

Demosthenes, *The Olynthiacs and the Philippics;* Aristophanes, two plays.

(Not given in 1915-1916).

53. Herodotus: Theocritus. 3 hrs.

Herodotus, *Histories, VII and VIII* (Smith and Laird: A. B. Co.); Theocritus, *Select Elegies* (Kynaston: Clarendon Press).

Prose composition for Honors students.

Honors and Graduate Courses.

101. Plato, The Republic. 2 hrs.

An intensive study of some portions of this work, more particularly directed towards the political thought of Plato and a comparison of it with that of Aristotle. Private reading of the remainder.

(Not given in 1915-1916).

102. Sophocles. 2 hrs.

A critical study of two of the tragedies—*Oedipus Tyrannus* and *Oedipus Coloneus* for the current year—and private reading of the remainder.

111. Greek Syntax. 1 hr.

Detailed studies of special points in Greek syntax.

112. Greek Private Life. 1 hr.

A series of lectures on Greek private life, accompanied by a course of parallel readings in the chief authorities.

Graduate Courses in Classics.

Candidates for the master's degree in Classics will take Latin 53, 102, 111; Greek 53, 102, 111 (or 112).

DEPARTMENT OF DRAWING AND DESCRIPTIVE GEOMETRY

Professor .... William Muir Edwards, M.Sc.
Assistant Professor .... James Adam, M.A.

The course in Freehand Drawing is related to the subjects of Applied Science. It aims at enabling the student to obtain proficiency in forms of draughtsmanship (such as perspective views, dimensioned sketches and lettering) requisite for the architect and the engineer.

Junior Courses.

2. Elementary Mechanical Drawing. 3 hrs. lab.

Exercises in the use of instruments; projection; drawing conventions; isometric drawing; simple machine details; timber framing; tinting and tracing.

Required of first year students in Engineering.

3. Freehand and Lettering. 3 hrs. lab.

Required of all first year students in Applied Science.

4. Descriptive Geometry. 6 hrs. lab.

Fundamental problems in geometrical drawing including

construction of polygons, similar figures, tangency, proportion and areas, conic sections, spirals and cycloidal curves.

Representation of points, lines, planes and solids by orthographic and metric projection; problems of the point, line and plane; sections of solids; projection of curves and curved surfaces; intersection and development of surfaces; tangent planes; shades and shadows.

Text Book: Smith, *Descriptive Geometry* (Magraw-Hill Co.)

Required of all first year students in Applied Science.

5. Machine Drawing. 3 hrs. lab.

Elementary principles of mechanical drawing and draughtmanship, preparation of working drawings of simple machine details, making dimensioned sketches and drawings of machines and their parts, preparation of tracings and blue prints.

Required of second year students in Engineering.

EDUCATION

(See Department of Philosophy)

DEPARTMENT OF ELECTRICAL ENGINEERING

Professor of Physics . . Robert William Boyle, M.Sc., Ph.D.
Lecturer in Electrical Engineering
Hector John Macleod, B.Sc.
Assistant Professor of Mechanical Engineering
Charles Alexander Robb, S.M.

51. Theory of Direct Currents. 3 hrs.

The theory of the direct current circuit and direct current transmission of power; study of storage batteries, direct current dynamos and motors, and their operating characteristics; construction and action of direct current-measuring instruments and protective devices.

Required of third year students in Electrical Engineering.

52. Direct Current Laboratory. 6 hrs. lab.

Operation of and experiments on storage batteries, direct

current dynamos, motors, and motor-generating sets; use of measuring instruments, controlling and protective devices, Special attention is to be given to the preparation of reports on all work performed in the laboratory.

Required of third year students in Electrical Engineering.

53. Electrical Engineering. 2 hrs.

The laws of electromagnetism; continuous and alternating current flow in various circuits; characteristics of direct and alternating current machinery; the fundamental principles of electric lighting and power distribution.

Required of fourth year students in Civil and Mining Engineering.

54. Machine Design. 2 hrs.

The principles of stresses and strength of materials as applied to particular parts of machines and machine fastenings, such as bolts, nuts, keys, cotters, and rivetted joints.

Text Book: Unwin, *Machine Design*, Part I. (Longmans, Green).

Required of third year students in Electrical Engineering.

55. Mechanics of Machines.

Discussion of and problems on the principles involved in the design of gear trains, gear teeth, valves, valve gears, valve diagrams, etc.

Text Book: Schwamb and Merrill, *Elements of Mechanism* (Wiley).

Required of third year students in Electrical Engineering.

56. Mechanical Drawing. 3 hrs. lab.

Preparation of working drawings, tracings, etc., the principles discussed in the lectures of Mechanics of Machines being used to design cams, quick return motions, gear teeth, valves and valve gears.

Required of third year students in Electrical Engineering.

DEPARTMENT OF ENGLISH

Professor .... Edmund Kemper Broadus, M.A., Ph.D.
Assistant Professor .... Robert Kay Gordon, M.A.

Immediately after registration, all matriculants, whether they submit accredited certificates or not, are required to write a theme, the subject to be chosen from a list provided by the instructor. Should this theme fall below a standard of average excellence, the student will be required to take a special course in composition, lasting as long as the instructor shall deem necessary. No credit toward the degree will be given for this work, but students assigned to the course must comply with its conditions and show satisfactory improvement in composition before they can advance to their degree.

Junior Courses.

1. Composition. 3 hrs.

The writing of weekly essays will be required throughout the year. The subject for these will be derived from clas-discussion of the selections in Roe and Elliott: *English Prose* (Longmans).

The following texts will also be studied with special regard to the principles of composition which they illustrate.

A Century of English Essays (Everyman's Library: Dent). Swift, *Gulliver's Travels* (Macmillan). Burke, *Speech on Conciliation* (Houghton Mifflin). *English Narrative Poems* (Macmillan).

Required of first year students in Arts and Applied Science.

2. History of English Literature. 3 hrs.

A survey course in the history of English Literature. Lectures on the history of English Literature with study of selections from the following authors: Chaucer, Spenser, Shakespeare, Bacon, Milton, Dryden, Swift, Addison, Pope, Johnson, Wordsworth, Coleridge, Byron, Keats, Shelley, Scott, Arnold, Ruskin, Dickens, Thackeray, Browning, Tennyson.

Text Books: Moody and Lovett: *History of English Literature* (Scribner); Dixon and Grierson: *The English Parnassus* (Oxford); Manly: *English Prose* (Ginn); Shakespeare: *Macbeth* (The Tudor Shakespeare).

The following books are required as collateral reading: Shakespeare, *Twelfth Night* (Tudor Shakespeare); Fielding, *Joseph Andrews;* Scott, *Kenilworth*; Thackeray, *Esmond.*

Senior Courses.

51. Poetry and Prose of the Nineteenth Century. 3 hrs.

Special study of Wordsworth, Tennyson, Browning, Carlyle, Ruskin and Arnold.

52. History of English Fiction. 3 hrs.

Lectures on the development of English Fiction with special study of selected masterpieces from Richardson to Thomas Hardy.

Text Book: W.L. Cross, *The Development of the English Novel* (Macmillan).

53. Shakespeare. 3 hrs.

A brief introductory outline of pre-Elizabethan drama and of Elizabethan stage-problems. Critical discussion of the major plays of Shakespeare and of the sonnets.

Text Book: *Shakespeare, Cambridge edition,* ed. Neilson (Houghton Mifflin Co.).

Honors Courses.

101. Old and Middle English Literature and Language. 3 hrs.

1. Old and Middle English ,a reading course.

Text Books: Sweet, *Anglo-Saxon Reader;* Morris and Skeat, *Specimens of Early English* (Clarendon Press).

First half-year, two hours.

2. The History of the English Language.

Text Book: Emerson, *History of the English Language* (Macmillan).

First half-year, one hour.

3. Chaucer.

Text Book: Skeat, *Student's Chaucer* (Clarendon Press).

Second half-year, two hours.

4. The History of the English Language.

Text Book: Emerson, *History of the English Language* (Macmillan).

Second half-year, one hour.

102. The Elizabethan Drama. 3 hrs.

Lectures on the origin and development of the English drama, with critical discussion of the major contemporaries of Shakespeare.

Text Book: W. A. Neilson, *The Chief Elizabethan Dramatists* (Houghton Mifflin Co.).

FRENCH

(See Department of Modern Languages)

DEPARTMENT OF GEOLOGY

Professor .... John Andrew Allan, M.Sc., Ph.D.
Lecturer .... Alan Emerson Cameron, M.Sc.

Senior Courses.

51. General Geology. 3 hrs. lect., 3 hrs. lab.

General survey; the processes of destruction and reconstruction; a short course in mineralogy and structural geology; the larger physiographical features and the general succession and distribution of geological formations in North America; the stratigraphy of Canada. The lectures will be illustrated by maps, lantern slides and models.

Field excursions will be made to localities in the vicinity where geological processes and forms may be observed. Maps, minerals, fossils and rocks will be studied in the laboratory.

Text Book: Scott, *An Introduction to Geology* (Macmillan).

Reference Book: Chamberlain and Salisbury, *Geology* (Murray).

Open to third and fourth year students in Arts and Sciences.

52. 3 hrs. lect., 3 hrs. lab.

Dynamical Geology. Geological processes of erosion, sedimentation, deformation and eruption. Lectures will be illustrated by lantern slides and maps.

Structural and Applied Geology. Structural features of the lithosphere; general application of geology to engineering problems; mathematics of folding, faulting and jointing; practical problems.

Lithology. Common rock-forming minerals and main rock types.

Text Books: Scott, *An Introduction to Geology* (Macmillan); Pirsson, *Rocks and Rock Minerals* (Wiley); Ries, *Engineering Geology* (Wiley).

Reference Books: Hayes, *Handbook for Field Geologists* (Wiley); Geikie, *Structural and Field Geology* (Van Nostrand).

Required of third year students in Engineering.

53. 3 hrs. lect., 3 hrs. lab.

Mineralogy. Principles of crystallography; optical properties of crystalline material under the polarizing microscope; calculation of mineral formulae; principles of mineral classification; determination of certain common minerals and metals by means of the blowpipe.

Petrology. The principles of rock classification ;a systematic study of the chief rock types; a classification of igneous rock bodies.

Economic Geology. Occurrence of certain mineral deposits; non-metallic mineral products and resources, including building materials, coal, petroleum and natural gases; the natural resources of the Province of Alberta.

Text Books: Moses and Parsons, *Mineralogy, Crystallography and Blowpipe Analyses* (Van Nostrand); Brush and Pen-

field, *Manual of Determinative Mineralogy and Blowpipe Analyses* (Wiley); Pirsson, *Rocks and Minerals* (Wiley).

Reference Books: Dana, *A System of Mineralogy* (Wiley); Harker, *Perology for Students* (Cambridge University Press); Ries, *Economic Geology* (Macmillan).

Open to fourth year students in Arts and Sciences.

54. 3 hrs. lect., 3 hrs. lab., first half
1 hr. lect., 3 hrs. lab., sec. half.

Mineralogy. Two hours. Descriptive and determinative mineralogy and crystallography; crystal systems and laws of symmetry; calculation of mineral formulae; principles of classification; physical properties of all common minerals and metals.

Determinative Mineralogy. Three hours lab. Analysis of a mineral with the blowpipe and methods of distinguishing it by other physical properties.

Canadian Geology. One hour, first half. Description of geology and mineral resources of Canada.

Text Books: Moses and Parsons, *Mineralogy, Crystallography and Blowpipe Analyses* (Wiley); Brush and Penfield, *Manual of Determinative Mineralogy and Blowpipe Analyses* (Wiley).

Reference Books: Dana, *A System of Mineralogy* (Wiley). Geological Survey of Canada Publications.

Required of third year students in Mining Engineering.

55. 3 hrs. lect., 3 hrs. lab.

(a) **Petrography.** The principles and applications of the polarizing microscope ;the preparation of thin sections of rocks will be studied. The determination of the important rock types; and the quantitative measurements of the mineral composition of certain rocks will be made by means of the microscope.

Text Books: Iddings, *Igneous Rocks* (Wiley); Johannsen, *Determination of Rock-forming Minerals* (Wiley).

(b) **Ore Deposits.** Mode of occurrence and geological

relations of various types of ore deposits particularly in North America.

Text Book: Kemp, *Ore Deposits of the United States and Canada* (McGraw-Hill).

(c) **Paleontology.** A general survey of faunal development in North America, with a careful study of certain index fossils in each of the periods.

Reference Books: Shimer and Grabau, *North American Index Fossils* (Seiler); Zittel, *Text-book of Paleontology* (Macmillan); Osborn, *Age of Mammals* (Macmillan).

or

(d) **Mineral Resources.** A general course in clay, coal, gas, petroleum, metals and building stone resources in Alberta.

References: Reports of Department of Mines, journals and periodicals.

(e) **Geological Colloquium.** As in Geology 60.

Open to fourth year students in Arts.

56. 1 hr. lect., 3 hrs. lab., first half.

Petrology. A detailed study will be made of various methods of rock classification. The megascopic characters of the important types of rock will be examined; especially those characters which will enable the student to determine the rocks in the field.

Text Book: Harker, *Petrology for Students*, (Cambridge University Press).

Reference Books: Iddings, *Igneous Rocks*, (Wiley); Daly, *Igneous Rocks and their Origin* (Wiley).

Required of fourth year students in Mining Engineering.

57. 1 hr. lect., 3 hrs. lab., sec. half.

Petrography. This course is designed for mining students in the fourth year and advanced students in Arts and Sciences. The course includes the principles, construction and practical application of the polarizing microscope; the optical properties of the common rock forming minerals; and especially the microscopic determination of the important

rock types. The laboratory work consists of the study of these sections of rock and minerals under the polarizing microscope.

(Continuation of Geology 53 and 54).

Text Book: Johannsen, *Determination of Rock-forming Minerals*, (Wiley).

Reference Books: Iddings, *Rock Minerals;* Johannsen, *Manual of Petrographic Methods*, (McGraw-Hill).

Required of fourth year students in Mining Engineering.

58. 3 hrs. lect., 3 hrs. lab., sec. half.

Ore Deposits and Economic Geology.

This course includes the classification of ore deposits; theories as to the origin, method of occurrence, and geological relations of various types of ore deposits, particularly in North America. The lectures will be illustrated with specimens and lantern slides.

Text Books: Lindgren, *Mineral Deposits* (McGraw-Hill) Ries, *Economic Geology* (Macmillan); Kemp, *Ore Deposits of the United States and Canada* (McGraw-Hill); Phillip and Lewis, *Treatise on Ore Deposits* (Macmillan).

Required of fourth year students in Mining Engineering.

59. 1 hr. lect., 1 hr. lab., first half.

Clays and Clay Products. This course deals with the origin, occurrence and properties of the clay resources, particularly in Western Canada. The products manufactured from clay, shale and marl will be discussed.

The laboratory course will consist in testing clays, and in making and burning brick, tile and sewer pipe.

Reference Books: Ries and Keele, *Clay and Shale Deposits of the Western Provinces*, (Geol. Survey, Canada). Ries, *Clays, their Occurrence, Properties and Uses* (Wiley); Eckel, **Building Stones and Clays** (Wiley).

Required of fourth year students in Mining Engineering.

60.

Geological Colloquium. One hour a week in the first

half year will be spent reading and discussing various reports and works on Geology.

Required of fourth year students in Mining Engineering.

Honors Courses.

The courses will be selected from the following:

101. Canadian Geology.

A study of the distribution of the geological formations and the mineral resources of Canada.

102. Stratigraphical Geology.

A study of the large stratigraphic features of the earth; correlation of the geological history of one continent with another.

103. Petrography.

As in 57.

104. Crystallography.

A calculation of the axial ratios of crystals; measurement of crystal and axial angles; measurement of indices of refraction of minerals and liquids by various methods.

(Omitted in 1915-16).

105. Ore deposits and Economic Geology.

(As in 58).

106. Mineral Resources of Alberta.

(As in 55d).

107. Geological Colloquium.

(As in 60, with additional reading).

GERMAN

(See Department of Modern Languages)

GREEK

(See Department of Classics)

DEPARTMENT OF HEBREW

Special Lecturer . . David Edward Thomas, B.A., B.D., Ph.D.

Senior Courses.

51. Elements of Hebrew. 3 hrs.

An inductive study of the Elements of the Hebrew language, based on Genesis, chapters 1-8.

Text Books: Harper's, *Elements of Hebrew* and Harper's *Introductory Method and Manual.*

52. Old Testament Historical Literature. 3 hrs.

A critical reading, with special emphasis on syntax, of selected portions of Deuteronomy, the Historical Books and the easier Prophetic Books.

Text Books: *The Hebrew Bible* and *Genesius' Hebrew Grammar* (latest edition).

DEPARTMENT OF HISTORY AND POLITICAL ECONOMY

Professor .... The President of the University.
Assistant Professor ..... Gordon Stanley Fife, B.A.
Lecturer .... Alfred Leroy Burt, B.A

Junior Courses.

1. 3 hrs.

(a) A study of the British Colonial period; a comparison of the British and Colonial constitutions.

(b) The outlines of general history from the Renaissance to the present day.

Text Books: Seebohm, *The Era of the Protestant Revolution;* Robinson and Beard, *The Development of Modern Europe;* Members of the Oxford Faculty of Modern History, *Why we are at War.*

Required of all first year students in Arts and Architecture.

2. 3 hrs.

British History from the Tudor period to the present day.

Text Books: Gardiner, *Student's History of England, Vols. II and III;* Egerton, *Short History of British Colonial Policy;* Gooch, *Political Thought from Bacon to Halifax;* Barker, *Political Thought from Spencer to to-day.*

Required of all second year students in Arts and Architecture in session 1915-16.

3. Economics (for students in Accountancy).

An elementary course in economics.

Text Book: Ely, *Outlines of Economics.*

4. Economics. A continuation of course 3 will be prescribed for students in the second year in Accountancy.

Senior Courses.

In Senior courses in History, periodical essays are required from all students.

After the session of 1915-16, courses 57 and 58 will be given in alternate years.

53. 3 hrs.

European History from the Barbarian invasions to the fall of the Hohenstaufen.

Text Books: Emerton, *Introduction to the Middle Ages;* Emerton, *Mediaeval Europe.* A list of reference books will be prescribed at the beginning of the session.

(Given in 1915-16).

Required of third year students in Architecture.

54. 3 hrs.

European History from the Renaissance to the end of the wars of religion. Students will be examined on: Symonds, *Short History of the Italian Renaissance;* Froude, *Life and Letters of Erasmus;* Lindsay, *History of the Reformation;* Harrison, *William the Silent;* Gardiner, *Thirty Years War;* Cambridge Modern History (selected chapters).

(Given in 1915-16).

55. 3 hrs.

General History from the Thirty Years War to the fall of Napoleon. Students will be examined on: Wakeman, *European History* 1598-1715; Hassall, *The Balonce of Power;* de Tocqueville, *France before the Revolution;* Rose, *Revolutionary and Napoleonic Era;* Morley, *Voltaire,Diderot* and *Rousseau,* (certain chapters).

(Given in 1916-17).

56. 3 hrs.

General History from the Congress of Vienna to the present day.

Fyffe's *History of Modern Europe* or Hazen's *Europe since* 1815 will be found useful for facts. Students will also be examined on: Bodley, *France;* Lichtenberger, *Germany and its Evolution in Modern Times;* Steed, *The Hapsburg Monarchy;* Fisher, *The Republican Tradition in Europe;* Caesaresco, *The Liberation of Italy;* Lowell, *Governments and parties in Continental Europe,* (certain chapters); Zimmern and others, *The War and Democracy.*

(Given in 1916-17).

57. 3 hrs.

English Constitutional History.

Text Book: Maitland, *Lectures on English Constitutional History* (Cambridge University Press). Students will also be examined on: Anson, *Law an Custom of the Constitution* (Macmillan); documents selected from the collections of Stubbs, Prothero, Gardiner and Robertson.

(Given in 1915-16).

58. 3 hrs.

Canadian Political and Constitutional History.

Students will be examined on: Egerton, *Canada* (vol. V, part II of Lucas, *Historical Geography of the British Colonies*); Munro, *The Seigneurial System in Canada;* Bradshaw, *Self-Government in Canada;* Lucas, *Lord Durham's Report,* Vols. I and II;

Egerton, *Federations and Unions within the Empire;* documents selected from the collections of Shortt and Doughty, Doughty and MacArthur, Egerton and Grant, and Houston.

(Given in 1916-17).

59. 3 hrs.

A general introduction to the study of political economy.

Text Books: Gide, *Principles of Political Economy;* Townsend Warner, *Landmarks in English Industrial History.*

(Given in 1915-16).

60. 3 hrs.

(a) History of Political Thought. General books: Pollock; *History of the Science of Politics;* Seeley, *Introduction to Political Science;* Dunning, *Political Theories from Luther to Montesquieu.* Students will also be examined on selections from Aristotle, *Politics;* Machiavelli, *The Prince;* Hobbes, *Leviathan;* Maine, *Ancient Law;* Bryce, *Studies in History and Jurisprudence,* Spencer, *The Man versus the State;* Dicey, *Law and Public Opinion in England.*

(b) Comparative Politics. Students will be examined on selected chapters from Lowell, *The Government of England;* Beard, *American Government and Politics;* Lowell, *Governments and Parties in Continental Europe;* Siegfried, *The Race Question in Canada.*

(Given in 1915-16).

Honors and Graduate Courses.

Advanced courses for Honors or for the master's degree will be arranged in conference with the head of the department.

ITALIAN

(See Department of Modern Languages)

LATIN

(See Department of Classics)

DEPARTMENT OF MATERIA MEDICA AND PHARMACY

Professor ....
Lecturer .... W. W. Hole.

MATERIA MEDICA

Courses.

1. General Materia Medica. 2 hrs. lect.

Drugs are studied in regard to their origin, characteristics and methods of production, in the following groups:

1. leaves, 2. flowers, 3. fruits, 4. seeds, 5. herbs and entire plant, 6. woods, 7. barks, 8. rhizomes, 9. roots, 10. gums, 11. resins, 12. gum-resins, 13. oleo-resins, 14. balsams, 15. oils, fats and waxes, 16. animal substances.

Required of first year students in Pharmacy.

2. Advanced Materia Medica. 1 hr. lect., 2 hrs. lab.

In the second year the work of the first year is elaborated and extended. Stress is laid upon the microscopical examination of the substances detailed in the first year course and their identification in powdered state.

Required of second year students in Pharmacy.

PHARMACY

1. General Pharmacy. 2 hrs. lect., 4 hrs. lab.

Lectures. Classification and consideration of the various preparations of the British Pharmacopoeia.

Laboratory. An extended practical course in dispensing and carrying out of the various galenical processes.

This course is completed in the first year by students in Pharmacy.

DEPARTMENT OF MATHEMATICS

Professor .... Ernest Wilson Sheldon, M.A., Ph.D.
Assistant Professor of Applied Mathematics
Samuel Douglas Killam, M.A., Ph.D.
Lecturer .... Cecil Ethelbert Race, B.A., C.A.
Instructor .... George Robinson, B.Sc.

Junior Courses.

1 and 2. Elementary Mathematics.

1. Lectures. 3 hrs.

Geometry. Proportion, similar figures; regular polygons; harmonic section; locus problems; elementary analytic geometry.

Algebra. Simple equations of one, two and three unknowns; graphical methods; progressions; ratio, proportion, variation; permutations and combinations; binomial theorem; theory of quadratics; logarithms.

Trigonometry. Elementary plane trigonometry.

Required of all first year students in Arts and Architecture.

2. 1 hr.

The technique of Mathematics 1.

Required of all first year students in Architecture and of all students who are taking Mathematics 1 in preparation for Engineering.

3. Algebra. 4 hrs.

Irrational and imaginary numbers; errors and approximations; theory of equations; determinants; partial fractions; infinite series and limits; derivatives; logarithms; the slide-rule; graphical algebra.

Text Books: Barnard and Child: *A New Algebra*, Vol. II (Macmillan); Slichter, *Elementary Mathematical Analysis* (McGraw-Hill).

Required of all first year students in Engineering, and of all second year students in Architecture.

4. Solid Geometry. 3 hrs., first half.

Fundamental propositions relating to lines and planes in space; mensuration of solid figures; the geometry of the sphere.

Text Book: Slaught and Lennes, *Solid Geometry* (Allyn and Bacon).

Required of all first year students in Engineering and of all second year students in Architecture.

5. Spherical Trigonometry. 3 hrs., sec. half.

Spherical trigonometry; review of plane trigonometry.

Text Book: Granville, *Plane and Spherical Trigonometry* (Ginn).

Required of all first year students in Engineering and of all second year students in Architecture.

6. Elementary Mechanics. 2 hrs., first half.

An elementary course of lectures and problems in dynamics and statics.

Required of all first year students in Engineering .

7. Solid Geometry and Algebra. 3 hrs.

(a) Solid Geometry. As in Mathematics 4.

(b) Algebra. As in Mathematics 3.

Open to second year students in Arts.

8. Analytical Geometry. 2 hrs., sec. half.

The point, straight line, circle, parabola, ellipse and hyperbola; an introduction to solid analytical geometry.

Text Book: Smith and Gale, *New Analytic Geometry* (Ginn).

Required of all first year students in Engineering.

9. Calculus. 3 hrs.

The derivative and the differential; rates; maxima and minima; points of inflection ;curvature; the anti-derivative and the definite integral; length; area; volume; mean values; methods of approximation; double and iterated integrals; elementary differential equations.

Text Books: Mercer, *The Calculus for Beginners* (Cambridge University Press); Osgood, *Differential and Integral Calculus* (Macmillan).

Required of all second year students in Engineering.

11. Mechanics. 3 hrs.

General Principles of statics and dynamics of a particle; motion under varying force; simple harmonic motion, oscillation of springs and simple pendulum.

Text Book: Slocum, *Theory and Practice of Mechanics* (Holt).

Required of all second year students in Engineering.

41. Elementary Commercial Mathematics.

(a) Arithmetic. Interest and discount; exchange; commission; insurance; stocks and bonds; annuities.

Required of all students in the School of Accountancy who are preparing for the Intermediate Examination of the Institute of Chartered Accountants of Alberta.

(b) Algebra. As in Mathematics I.

Required of all students who are preparing for the Diploma in Accountancy.

42. The Mathematics of Investments.

Limits and series; interest; annuities; amortization; valuation of bonds; sinking funds and depreciation.

Text Book: Skinner, *The Mathematical Theory of Investments* (Ginn).

Required of all students who are preparing for the Diploma in Accountancy.

Advanced Courses.

Students in the Faculty of Arts who intend to read for honors are required to take the advanced courses of the first and second years.

First year. As in Mathematics 7.

Second year. As in Mathematics 51.

Senior Courses.

51. Calculus and Analytical Geometry. 4 hrs.

As in Mathematics 8 and 9, with additional topics. Open to second and third year students in Arts.

52. Advanced Calculus. 3 hrs.

A second course in the Calculus. Taylor's theorem; partial differentiation; complex numbers and vectors; multiple integrals; differential equations.

Text Books: Osgood, *Differential and Integral Calculus* (Macmillan); Wilson, *Advanced Calculus* (Ginn).

Required of all third year students in Electrical Engineering; open to third and fourth year students in Arts.

53. Astronomy. 3 hrs.

General survey of the fundamental concepts of astronomy, including astro-physics and descriptive astronomy.

Text Book: Young, *A Manual of Astronomy* (Ginn).

Open to third and fourth year students in Arts.

54. Advanced Mechanics. 2 hrs., first half.

Review of the principles discussed in Mathematics 11; friction; dynamics of rotation with application to compound pendulum; impulse and energy of motion ;impact.

Text Book: Slocum, *Theory and Practice of Mechanics* (Holt).

Required of all third year students in Civil, Electrical and Mining Engineering.

Honors Courses.

101. Theory of Functions. 1 hr.

Elements of the theory of functions of real and complex variables.

102. Graphical and Numerical Methods. 2 hrs., sec. half.

Graphical calculations and their application to analysis and algebra; nomography.

Text Book: Runge, *Graphical Methods* (Columbia University Press).

103. Solid Analytic Geometry. 2 hrs., first half.

Loci of the equations of first and second degree in three variables; elementary differential geometry of skew curves.

104. Projective Geometry.

The principle of duality; primitive forms of one, two and three dimensions; coordinate systems; projective transformations.

Not given in 1915-16.

Graduate Courses.

Candidates for the master's degree will take selected honors courses, do collateral reading and write a thesis.

MINERALOGY

(See Department of Geology)

DEPARTMENT OF MINING ENGINEERING

Professor .... John A. Allan, M.Sc., Ph.D.
Lecturer .... Alan Emerson Cameron, M.Sc.

Senior Courses.

Courses 52-56 are required of third year students in Mining Engineering; courses 57-62 of fourth year students.

52. Ore Dressing. 2 hrs. lect., sec. half.

Theoretical considerations affecting separations and concentrations, mechanical operations involved, ore dressing machinery and apparatus, breakers, screens and classifiers, jigs, vanners, tables, etc. The course to be continued into the fourth year.

53. Mine Survey School.

A series of trips about the local mines to study at first hand the different methods of mining. Detailed reports on each mine visited will be required of each student with sket-

ches and diagrams of objects of special interest. The work will include a short underground survey course.

54. Assaying. 1 hr. lect., first half, 3 hrs. lect.

Lectures and laboratory work. Furnaces balances and other apparatus used in assaying. Sampling and preparation of ores for assaying. Laboratory work in the assay of gold, silver, copper, lead, etc., ores; of bullion, mattes and slags.

Text Book: Fulton, *A Manual of Fire Assaying.*

55. Metallurgy. 2 hrs. lect., sec. half.

Study of metallurgical fuels. Methods of the preparation of coke for blast furnace use; occurrence, preparation and use of liquid and gaseous fuels ;calorimetry and pyrometry; alloys of metals; occurrence, preparation and use of refractory materials.

56. Mining Enginering.
1 hr. lect., first half, 2 hrs. lect., sec. half.

Principles and practices of mining, with special reference to coal mining, earth excavation, explosives and blasting; drills and drilling; gold washing and dredging, hydraulic mining; quarrying and open cut mining; deep drilling, etc. The course to continue into the fourth year.

57. Metallurgy. 2 hrs. lect.

Metallurgy of iron and steel. Metallurgy of copper, lead and zinc.

58. Mining Engineering. 3 hrs. lect., first half.

Shaft sinking, drifting, underground development, timbering, hauling, hoisting, drainage and pumping, lighting and ventilation, general mine and plant design, administration, examination and valuation of mines, etc. A continuation of the third year work.

59. Mining Machinery. 3 hrs. lect., sec. half.

Machinery of haulage, hoisting, pumping, ventilation, power plants, mine and mill buildings, compressors, etc. Head frames and tipples, ore bins, etc.

60. Mine Design. 3 hrs. lab., sec. half.

Layout and plant equipment for a mine. Specifications and construction, approximate dimensions, capacities and costs.

61. Ore Dressing and Milling. 2 hrs. lect., sec. half.

Crushers and concentrating machines, coal breakers and coal washing, stamp milling, amalgamation and cyanidation of gold and silver ores, etc. A continuation of the third year course.

62. Mining Colloquium. 1 hr., sec. half.

Reading and discussion of papers on metallurgy, mining and ore dressing.

DEPARTMENT OF MODERN LANGUAGES

Professor .... W. A. R. Kerr, M.A., Ph.D.
Professor of German .... Barker Fairley, M.A., Ph.D.
Lecturers in French .... Edouard Sonet, B-ès-L.
John Burgon Bickersteth, M.A.
Lecturer in German ....

In the Junior Courses the central aim will be the practical acquisition of the living language studied. To this end, especially in the first year, particular emphasis will be laid on exercises in pronunciation, conversation and composition. In this branch of the work twenty-five per cent. of the total marks will be allotted to oral proficiency. A considerable amount of reading will be done. This will consist, in the main, of representative modern prose; attention, however, especially in the second year, will also be directed to writers of the classical periods. Regular reports will be required on collateral reading.

In the Junior courses Authors and Prose Composition must be passed separately.

In the Senior courses stress will continue to be laid on the practical side of language study. With regard to the authors, special topics connected with the literary movements of the eighteenth and nineteenth centuries will be studied. Essays and regular reports will be required on collateral reading.

FRENCH

A. An introductory course for students entering the University with a condition in French. This course cannot be credited towards a degree and is planned simply to enable students to make up deficiencies in matriculation.

Junior Courses.

1. Authors. 2 hrs.

Balzac, *Le Colonel Chabert* (*La Peau de Chagrin; Le Curé de Tours; Le Colonel Chabert;* Nelson's); Merimée, *Tamango* (Blackie); Daudet, *Lettres de mon Moulin* (Oxford Press); Bazin, *Les Oberlé* (Holt).

3. Composition. 1 hr.

Review of grammar, practice in colloquial French.

Text Book: Vreeland and Koren, *French Syntax and Composition* (Holt).

Course 3 constitutes in combination with course 1 the French requirement of the first year.

2. Authors. 2 hrs.

The course will consist chiefly of a study of French drama and dramatic theories of the classical period.

Molière, *Le Misanthrope* (Macmillan); *Tartuffe* (Heath); *Les Femmes Savantes* (Macmillan); Corneille: *Le Cid* (Macmillan); *Polyeucte* (Heath); Racine, *Andromaque, Britannicus* (Holt).

The collateral reading will be devoted to the non-dramatic literature of the seventeenth century and will include ex-

tracts—as contained in Warren's *French Prose of the XVII Century* (Heath)—from the work of Descartes, Pascal, Larochefoucauld, Bossuet and Labruyère; Madame de Lafayette; *La Princesse de Cleves* (Ginn); Lafontaine: *Fifty Fables* (American Book Company).

4. Composition. 1 hr.

Review of grammar; practice in colloquial French. Text Book: Vreeland and Koren, *French Syntax and Composition* (Holt).

Course 4 constitutes in combination with course 2 the French requirements of the second year.

41. 2 hrs.

(a) Authors. Labiche, *La Grammaire* (Ginn); careful reading in class of various scientific articles and extracts in Bowen, *Scientific French Reader* (Heath); J. Luquiens, *Popular Science* (Ginn).

(b) Composition. Practice in colloquial French; drill in the essentials of French grammar. Kerr and Sonet, *French Grammar* (Macmillan).

Required of first year students in Architecture and Medicine; open to first year students in Engineering.

42. 2 hrs.

(a) Authors. Bazin, *Les Oberlé* (Holt); reading in class of current scientific journals and magazines.

(b) Composition. Practice in colloquial French; review of grammar. Kerr and Sonet, *French Grammar* (Macmillan).

Senior Courses.

Required of second year students in Architecture; open to second year students in Engineering.

51. 3 hrs.

The first term will be devoted to French Literature in the XVIII. Century. Lesage, *Turcaret* (Heath); Marivaux, *Comé-*

dies (Macmillan); Beaumarchais, *Le Barbier de Séville;* Voltaire, *Contes* (Oxford Press); *Zaïre* (Heath); Rousseau, *Petits Chefs d'Oeuvres* (Firmin-Didot).

The collateral reading with essays and reports in French, will be Berthon's *Specimens of Modern French Verse* (Macmillan), and Canfield, *French Lyrics* (Holt); but considerable outside reading will be required with conferences, essays and reports in French.

(b) Composition. Practice in colloquial French. Text Book: Cameron, *French Composition* (Holt).

Not given in 1915-16.

52. Nineteenth Century Literature. 6 hrs.

First Part: The period of Romanticism. Chateaubriand, *Atala* (Heath); Hugo, *Hernani, Ruy Blas* (Heath); Balzac, *César Birotteau* (Oxford Press); Alfred de Musset; *Trois Comédies* (Heath); Gauthier, *Jettatura* (Heath).

Second Part: Later Nineteenth Century Literature. Augier, *Le Fils de Giboyer* (Allyn and Bacon); *Contes des Romanciers Naturalistes* (Heath); France, *Crime de Sylvestre Bonnard* (Holt); Renan, *Souvenirs d'Enfance et de Jeunesse* (Heath); Rostand, *Chantecler;* Maurice Maeterlinck, *Selections* (Nelson).

A considerable amount of collateral reading with conferences, essays and reports in French will also be required.

Composition. Practice in colloquial French three hours a week.

Honors Courses (extending over two years).

101 and 102. (a) Romanic Philology.

Old French: Phonology and Morphology; Schwann-Behrens, *Altfranzoesische Grammatik.* Texts: *La Chanson de Roland;* Chrestien de Troyes; *Aucassin et Nicolette.*

Old French Literature: Survey of Mediaeval Literature. G. Paris: *La Littérature Française au Moyen Age.* Rapid reading of texts with consideration of their literary relations. Two hours.

(b) Romanic Seminary.

French Literature: Study in special field; Literature of the Eighteenth Century. Discussions, reports and a thesis. One hour.

Graduate Courses.

Graduate students desiring courses in French should consult the head of the department.

ITALIAN

51. 3 hrs.

Grandgent, *Italian Grammar* (Heath); Grandgent, *Italian Composition* (Heath); Fogazzaro, *Pereat Rochas*, (Heath); Dante, *Inferno* (Heath).

GERMAN

A. 3 hrs.

An introductory course for students entering the University with a condition in German. This course cannot be credited towards a degree and is planned simply to enable students to make up deficiencies in matriculation.

Junior Courses.

1. Authors. 2 hrs.

Drei kleine Lustspiele (Heath); Hatfield, *Shorter German Poems* (Heath); Raabe, *Die schwarze Galeere* (Oxford); Keller, *Kleider machen Leute* (Heath).

3. Composition. 1 hr.

Meyer, *German Grammar* (Sonnenschein); Hewitt, *Practical German Composition* (Heath). Practice in colloquial German, prose versions.

Course 1 constitutes in combination with course 3 the requirement of first year German.

2. Authors. 2 hrs.

Deutsche Reden (Heath); Heine, *Die Harzreise* (Oxford); Mörike, *Mozart auf der Reise nach Prag* (Heath).

Outlines of the history of German literature in the 18th

century. Text Book: Collitz, *Selections from Classical German Literature*, (Oxford).

4. Composition. 1 hr.

Harris, *German Composition* (Heath). Practice in colloquial German, prose versions, free composition.

Course 2 constitutes in combination with course 4 the requirement of second year German.

41. 2 hrs.

Reading of elementary texts and introduction to scientific German. Authors: Wildenbruch, *Das edle Blut* (Heath); Wallentin, *Grundzuege der Naturlehre* (Heath). Grammar: Meyer, *German Grammar* (Sonnenschein).

42. 2 hrs.

Reading of general and scientific texts, including the study of chosen articles from current scientific journals. Authors: Baumbach, *Der Schwiegersohn* (Holt); Sudermann, *Frau Sorge* (Holt); Wait, *German Scientific Reader* (Macmillan).

Senior Courses.

51. 3 hrs.

(a) Reading of a number of essays on Germany and German life. Text Book: *Lesebuch zur Einfuehrung in die Kenntnis Deutschlands und seines geistigen Lebens* (Paszkowski, Berlin). Reports and discussions.

(b) History of German Drama in the 19th century. Text Books: Kleist, *Der Prinz von Homburg* (Oxford); Grillparzer, *Der Traum ein Leben* (Heath), *Libussa* (Oxford); Hebbel, *Herodes und Mariamne* (Holt), *Agnes Bernauer* (Oxford); Ludwig, *Der Erbfoerster* (Holt); Wagner, *Die Meistersinger* (Ginn); Hauptmann, *Die Versunkene Glocke* (Holt). Collateral reading, essays and reports.

(c) Advanced prose versions. Ehrke, *Guide to Advanced German Prose Composition* (Oxford).

52. 3 hrs.

(a) see 51 (a).

(b) General study of Goethe's works, ed. Inselverlag, *Poems and Ballads* (Vol. 1, pp. 1-212), *Faust I and II* (Act 5); *Wilhelm Meisters Lehrjahre, Dichtung und Wahrheit.* Collateral reading, essays and reports.

(c) See 51 (c).

Not given in 1915-16.

101 and 102. Honors Courses (Extending over two years).

(a) Germanic Philology: Historical Grammar, Reading of Middle High German texts. Paul, *Mittelhochdeutsche Grammatik* (Halle). Text Books for 1914-15: *Kudrun* (ed. Martin, Halle).

(b) German Literature: Study in special field with thesis, discussions and reports. For 1914-15: Friedrich Hebbel, *Plays.*

Graduate Courses.

Graduate students desiring courses in German should consult the head of the department.

DEPARTMENT OF PATHOLOGY

Lecturer ....

Courses.

51. General Pathology. 2 hrs. lect., 4 hrs. lab.

In the third year, lectures on the subject of general patho logy, on inflammation, ulceration ,tissue repair and tumor formations, are given and this is supplemented by (1), a practical course in pathological histology, teaching the preparation and the study of microscopic sections illustrating the lectures. (2) A course in clinical pathology illustrative of gross pathological conditions, haemotology and clinical microscopy.

52. Pathological Chemistry. 3 hrs. lab.

Students in the third year receive practical instructions in

chemical methods of examination of body fluids, exudates, secretions and tissues, necessary for the proper interpretation of disease .

DEPARTMENT OF PHARMACOLOGY AND TOXICOLOGY

Professor ....
Lecturer .... W. H. Hole.

PHARMACOLOGY

Courses.

51. Medical Pharmacology. 2 hrs., sec. half.

The study of the typical drugs in the British Pharmacolo-

The study of the typical drugs in the British Pharmacopoeia This course is combined with the advanced courses in Physiology, and is supplemented by a special course in Practical Pharmacy.

Required of third year students in Medicine.

1. General Pharmacology. 2 hrs. lab., first half.

The action of drugs in the human body is taught in detail with demonstrations of the action of certain drugs on anaesthetized or decerebrate animals to facilitate the proper interpretation of graphic records.

Required of first year students in Pharmacy.

Text Books: Cushny, *Pharmacology* (Lea); Dixon, *Pharmacology* (Longmans).

2. Advanced Pharmacology. hrs.

Continuation of preceding course; standardization of the potency of drugs; preparation of extracts of glandular substances.

Required of second year students in Pharmacy.

Text Books as for Course 2.

TOXICOLOGY

1. General Toxicology. 1hr. lect., 2 hrs. lab., first half.

The common poisons from the standpoint of occurrence;

factors influencing the selection of poisons, the actions, signs, symptoms and treatment. Emphasis is laid on prophylaxis. A short practical course in the detection of poisons is given.

Required of first year students in Pharmacy.

2. Analytical Toxicology.

The work of the first year is amplified and a detailed systematic practical course in the qualitative and quantitative determination of poisons is given.

Required of second year students in Pharmacy.

DEPARTMENT OF PHILOSOPHY

Professor . . . . . John Malcolm MacEachran, M.A., Ph.D.
Lecturer . . . . . Rupert Clendon Lodge, M.A.
Special Lecturer . . Samuel Walters Dyde, M.A., D.Sc., LL.D.

PHILOSOPHY

Junior Courses.

1. Psychology and Logic. 3 hrs.

Psychology. An introduction to general psychology. (2 hrs.).

Text Book: James, *Psychology, Briefer Course* (Holt).

Logic. Lectures on the origin and development of philosophic and scientific conceptions. (1 hr.).

Senior Courses.

51. History of Philosophy. 3 hrs.

(a) Ancient, Mediaeval and Modern Philosophy to Kant. (2 hrs.).

(b) Papers and discussions based upon the development of ethical ideals and theories. (1 hr.).

Text Books: Bakewell, *Source Book in Ancient Philosophy*, (Scribner); Rand, *Modern Classical Philosophers*, (Houghton, Mifflin); Rogers, *Student's History of Philosophy*, (Macmillan).

52. History of Philosophy. 3 hrs.

(a) Modern Philosophy from Kant to the present (2 hrs.).

(b) Papers and discussions based upon the problems of Contemporary Philosophy.

Text Book: Rand, *Modern Classical Philosophers*, (Houghton, Mifflin).

Reference Books: Falkenburg, *History of Modern Philosophy* (Holt).

In courses 51 and 52 an endeavour will be made to study the History of Philosophy in relation to the History of the Natural Sciences. Whetham, *Science and the Human Mind* (Longmans), is recommended for reference.

53. 3 hrs.

The Philosophical Basis of Aesthetics, Ethics and Religion. Selected readings, papers and discussions.

Honors Courses.

Candidates for honors will take the work of the senior courses on the History of Philosophy but a more intensive study will be required. In addition the following work will be necessary:

101. Greek Philosophy. 2 hrs.

This is an advanced course with special reference to Plato and Aristotle.

Required of third year honors students.

102. The Philosophy of Kant. 2 hrs.

Required of fourth year honors students.

Text Books: Watson, *Selections from Kant* (Maclehose), and *The Philosophy of Kant Explained* (Maclehose).

Honors students of both years will meet together once a week to discuss problems of contemporary philosophy. Selected readings and essays will be prescribed.

Graduate Courses.

Students in philosophy who have taken the work of the senior classes may take the following courses for the M.A. degree.

103. Contemporary Philosophy.

This will involve a study of recent movements in English and American Philosophy, viz: Idealism in its various forms, Realism and Pragmatism. Contemporary Philosophy in Germany and France will be studied with special reference to Wundt and Bergson respectively.

104.

An advanced course in one of the following: A period in the history of Philosophy, Ethics, Aesthetics, Metaphysics, Logic, the Philosophy of Religion.

PSYCHOLOGY

Junior Courses.

1. (See Philosophy). 2 hrs.

Senior Courses.

51. General and Social Psychology. 3 hrs.

(a) Advanced General Psychology. 2 hrs.

(b) Social Phychology.

Studies in the psychological basis of social phenomena. (1 hr.).

52. Comparative and Racial Psychology. 3 hrs.

(a) Comparative Psychology. The evolution of mind. (2 hrs.).

(b) Racial Psychology. Studies in the psychological basis of language, the myth, religion, art, custom and morality. (1 hr.).

Psychology 51 and 52 will be given in alternative years. Psychology 52 will be given in 1915-16.

53. Psychology in its relation to the practice of Medicine. 1 hr.

Honors and Graduate Courses.

Candidates for Honors may take in addition to the general courses of the year one of the following in which advanced and specialized work will be required:

101. Physiological Psychology.

102. Abnormal Psychology.

103. The Psychology of Religion.

These may also be taken as graduate courses.

EDUCATION

Senior Course.

51. History and Philosophy of Education. 3 hrs.

1. The History of Education. (2 hrs.).

Text Book: Monroe, *Text Book in the History of Education*, (Macmillan).

2. The Philosophy of Education. Lectures on educational ideals and the social aspects of education. (1 hr.).

DEPARTMENT OF PHYSICS

Professor .... Robert William Boyle, M.Sc., Ph.D.
Lecturer .... Stanley Smith, M.A., B.Sc.
Lecturer in Applied Electricity . . Hector John Macleod, B.Sc.

In the Junior courses the work in Physics is designed to give a student a general acquaintance with the range of physical phenomena, and to serve as an introduction to the more advanced courses in pure and applied science.

The Senior courses involve more frequent use of mathematics and more precise laboratory work than the junior courses.

Junior Courses.

1. General Elementary Physics 3 hrs.

The more important principles of mechanics, properties of matter, heat, sound, light, magnetism and electricity will

be treated in an elementary manner and illustrated by experiments.

Required of all first year students in Arts, Medicine and Pharmacy.

2. Physical Laboratory. 3 hrs.

Elementary experiments, mostly quantitative, will be performed to illustrate the subjects dealt with in course 1.

Required of all first year students in Medicine and Pharmacy.

3 and 4. 3 hrs.

(3) Properties of Matter and Heat.

(4) Sound and Light.

These courses are introductory to later courses in the various engineering departments and in architecture. They are required of all first year students in Applied Science, but may also be chosen by second year students in Arts and Sciences.

5. Physical Laboratory. 3 hrs.

Experiments, performed quantitatively, on the physical laws dealt with in courses 3 and 4.

6. Magnetism and Electricity 2 hrs.

This course is introductory to more advanced courses in electrical physics and electrical engineering, and is required of all second year students in Applied Science. It may also be chosen by second year students in Arts and Sciences.

7. Physical Laboratory. 3 hrs.

Experiments, performed quantitatively, on the laws of magnetism and electricity, dealt with in course 6.

8. General Physics 3 hrs.

This course is of a more advanced character than course 1, and is designed as far as possible to meet the requirements of students in the second year of Arts and Sciences, especially those who are training as teachers.

9. Physical Laboratory. 3 hrs.

Experiments on the subjects of course 8.

Senior Courses.

51. Physical Optics. 3 hrs.

Theory of optical instruments and of the phenomena depending on the wave theory of light.

52. Physical Laboratory. 3 hrs.

Experiments on the subjects of course 51.

53. Electricity. 2 hrs.

Theory and practice of absolute and comparative electric measurement, magnetic and electric testing; electric circuit with resistance, inductance and capacity; principles of electric waves; ionization.

Required of third year students in Electrical Engineering, open to senior students in Arts and Sciences.

54. Physical Laboratory. 6 hrs.

Laboratory work in connection with course 53.

55. Radiation. 3 hrs.

A course on heat, light and electro-magnetic radiations; also on cathode and X-rays, and the rays from radioactive substances.

56. Physical Laboratory. 3 hrs.

Laboratory work in connection with course 55.

57. Introduction to Mathematical Physics. 3 hrs

Honors and Graduate Courses.

101. Ionization and Radioactivity.

Lectures and laboratory work may be taken in ionization in cases and solutions, conduction of electricity through gases and radioactivity.

102. Electro-Magnetic Waves.

Lectures and laboratory work may be taken on the principles of electric waves and radio-telegraphy.

If students desire, other courses may be arranged instead of those just mentioned, in conference with the head of the department.

DEPARTMENT OF PHYSIOLOGY

Professor .... Heber H. Moshier, M.B.

Demonstrators .... William Westcott Hole.
Morton E. Hall, M.B.
Gordon C. Gray, M.B.

Junior Courses.

1. General Physiology. 3hrs. lect., 7 hrs. lab., sec. half.

This course is given entirely in the second half to enable the students to get the necessary ground work in anatomy in the first half.

The laboratories are equipped for individual work by the student.

Text Book: Halliburton, *Physiology*, (Blakiston).

Reference Books: Starling, *Physiology* (Chicago Medical Book); Stewart, *Physiology* (Wood); Howell, *Physiology* (Saunders); Cannon, *Physiology* (Harvard Univ. Press).

Required of second year students in Medicine.

2. Biochemistry. 3 hrs. lect., 4 hrs. lab., first half; 3 hrs. lect., 7 hrs. lab., sec. half.

This course is distinct from plant biochemistry and treats the subject purely in relation to animal life. The course is completed in the second year and comprises the study of colloids, carbohydrates, fats, proteins, enzymes, chemotaxis, fermentation and osmosis and applied biochemistry to digestion, blood, urine, milk and lymph.

Reference Books: Plimmer, *Biochemistry* (Longmans); Haliburton, *Essentials of Physiological Chemistry* (Longmans);

Hawke, *Physiological Chemistry* (Blakiston).

Required of second year students in Medicine.

Senior Courses.

51. Advanced Physiology. 2 hrs. lect., 2 hrs. lab.

This course includes the study of neurology and the special senses and topics of special interest in Physiology.

Text Books, as for course 1.

Required of third year students in Medicine.

52. Clinical Physiology. 4 hrs. lab.

This course is conducted in the wards of the Strathcona Hospital. Methods of the examination of patients are exemplified and practised. Ample facilities are afforded in the out-door department for individual student work.

Required of third year students in Medicine.

PSYCHOLOGY

(See Department of Philosophy)

DEPARTMENT OF SURGERY

Lecturer ....

51. . 2 hrs.

In the third year the course includes lectures in the general principles of surgery and clinical instruction in (a) Inflammatory processes; (b) Sepsis; (c) Haemorrhage; (d) Hernia; (e) Surgical Landmarks; (f) History-taking; (g) Wounds; (h) Fractures; (i) Bandaging.

TOXICOLOGY

(See Department of Pharmacology)

DEPARTMENT OF EXTENSION

Secretary .... Albert Edward Ottewell, M.A.

This Department is organized to help those unable to attend regular university classes and carries on work along the following lines:

Outlines are published for the assistance of debaters, and material on subjects of debate is lent by the University. This material is available to all residents of Alberta free of charge, except for return postage. During the academic year 1914-15, one hundred and five communities in Alberta were thus served by the department, and in addition nine communities outside of the province.

Special bulletins have been prepared on a number of subjects, including: Co-operative Trading; Co-operative Banking; Rural versus City Life; Consolidation of Rural Schools; Prohibition; Compulsory Military Training in Canada; Imperial Federation; Protection versus Free Trade; Single Tax; Woman Suffrage; Reciprocity with the United States; Peace versus War; Direct Legislation; Oriental Immigration; Government Ownership of Railways; Municipal Ownership of Public Utilities; Canadian Navy; Closed Shop; Commission Government of Cities; Home Rule for Ireland; Capital Punishment; Educational Qualification for Suffrage,

In addition to this, material has been provided on a large number of other subjects. A manual of instruction for debaters is also available.

In connection with this department a High School Debating League has been formed, in which fifteen schools entered for the session 1913-14, and twenty-three schools for the present session. A trophy known as the Rutherford Cup for High School debating, has been given by Dr. A. C. Rutherford for competition in this League. Last year this trophy was won by the Camrose High School.

Extension lectures are given on a number of subjects by the members of the University staff. During the session 1913-14, one hundred and fifty lectures were delivered, distributed among forty centres with an aggregate attendance of nearly fifteen thousand. This work was still further extended during the session of 1914-15. Two hundred and sixteen lectures were delivered at seventy-three centres, for most of which courses of from two to four lectures were arranged.

The aggregate attendance at these lectures was over twenty-five thousand. In the arrangement of the extension lectures this year adavantage was taken of the widespread interest in the war. Most of the lectures given were on subjects related thereto, and an endeavour was made to promote throughout the province a more intelligent patriotism.

Travelling Libraries and lantern slide service.

i. Travelling libraries are lent to communities where no public libraries exist. For this purpose about twenty-eight hundred volumes are at present available, and during the present session eighty-six communities have been thus served.

ii. Lantern slide service.

At the beginning of the session this department made an arrangement with a London firm to supply lantern slides illustrative of the European War. Several shipments were sent, showing the progress of events from month to month. Between 900 and 1000 slides have been received and most of them have been in continuous use, both by our own lecturers and by various organizations to which they have been lent. Lanterns fitted either for electricity or acetylene gas, have also been lent to literary and other societies throughout the province.

Enquiries concerning the work of this Department should be addressed to A. E. Ottewell, M.A., Secretary of the Department of Extension, University of Alberta, Edmonton.

Press Bulletins are published weekly during the academic term and sent to the newspapers of the Province.

AFFILIATED COLLEGES

ALBERTA COLLEGE

Theological College of the Methodist Church

Government

The management and direction of Alberta College are vested in a Board of Governors appointed every four years by the General Conference of the Methodist Church and incorporated by Act of Parliament.

The officers of the Board are:

Chairman—Hon. H. C. Taylor, M.A., LL.B.

Secretary—P. E. Butchart.

Treasurer—W. T. Henry.

Bursar—J. H Riddell, B.A., D.D.

Executive Committee—H. C. Taylor, M.A., LL.B.; P. E. Butchart; W. W. Chown; W. T. Henry; A. T. Cushing, B.A.; James Ramsey; E. Richardson; W. L. Armstrong, B.A., D.D.; J. F. Fowler; C. G. Corneille, B.A., B.D.

Faculty

Rev. J. H. Riddell, B.A., B.D., D.D. (Victoria College)
Principal, Professor of New Testament Exegesis and Literature

Rev. C. E. Bland, B.A. (McGill), B.D. (Wesleyan College)
Professor of Homiletics and Pastoral Theology

Rev. D. E. Thomas, B.A. (Nebraska), B.D. (Chicago), Ph. D. (Chicago)
Professor of Old Testament Languages and Literature

Rev. Clyo. Jackson, M.A. (Toronto)
Dean of the Preparatory Department and Lecturer in English and Moderns

Miss Nettie Burkholder, B.A. (Victoria), S.B. (Chicago)
Lady Principal nad Lecturer in English and Science

S. R. Laycock, B.A. (Toronto)
Lecturer in Classics

Miss Gretrude K. Trotter
Lecturer in Elocution and Oratory

Courses

Preparatory. Thorough courses of instruction are given in all subjects preparatory for university work and for studies in Theology.

Theology. (a) A course of study for non-graduate students, requiring attendance at College for three years subsequent to the completion of preparatory studies, and two years of study on circuit in a course prescribed by the General Conference and supervised by the College.

(b) A course of study for students who are graduates in Arts, comprising two years of college studies and additional studies for the years spent as probationers on circuit.

(c) A course of study leading to the degree of Bachelor of Divinity. This course which is open only to students who are graduates in Arts, comprises three full years of study in Theology. In this course the Scriptures are studied in the original languages and the early versions, and in every other way the course is designed to give the young minister a good foundation on which to build his life work.

This course is open to students of any denomination.

Residence

In the new college building, which has been erected at a cost of nearly $200,000, and which occupies a prominent position upon the University grounds, careful arrangements have been made to provide a home for every student at the College. Rooms and board are offered also to students of the University who may desire to make their home in the College. Such students will be received, as long as accommodations permit, on exactly the same terms as the college students, whether any classes are taken in the College or not, provided only that they observe the discipline of the College.

The college residence has large and comfortable rooms sufficient to accommodate, in all, one hundred and twelve students.

During 1914-15, there were one hundred and forty-five students in residence taking the preparatory, theological, or Arts courses.

ROBERTSON COLLEGE

Theological College of the Presbyteyrian Church

This college was placed by action of the General Assembly of 1910 in connection with the Provincial University. The name "Robertson College" was decided upon October 10, 1911, to perpetuate the memory of the pioneer missionary, the Rev. James Robertson.

Government

The management and direction of Robertson College are vested in a Board of Management and Senate, of which the following are officers:

Board of Management

Chairman—J. A. McDougall, Esq., Edmonton.
Vice-Chairman—R. J. Hutchings, Esq., Calgary.
Sec'y-Treasurer—A. F. Ewing, Esq., B.A., K.C., M.P.P., Edmonton.

Senate

Chairman—Principal S. W. Dyde.
Registrar—Prof. J. M. Millar.

Faculty for 1914-15

Rev. S. W. Dyde, M.A., D.Sc., LL.D., D.D.
Principal and Professor of Systematic Theology

Rev. J. M. Millar, M.A., B.D., D.D.
Professor of English Bible, Homiletics and Pastoral Theology

Rev. R. A. King, M.A., D.D.
Librarian and Lecturer in Apologetics and Missions.

Rev. A. T. Barnard, M.A.
Head of Extra-Mural Department

Students also attend university lectures in specified subjects.

Courses

Robertson College has during the past session co-operated with Alberta College in matriculation subjects as well as in Theology. This co-operative plan, which has proved highly successful, will be continued next session. Classes will open October 4, 1915. Details of the different courses may be obtained from Prof. J. M. Millar, 11112 85th Ave., Edmonton.

Extra-Mural Department

During the session 1914-15 twenty-two non-resident students were registered in this department. Information about the various courses will be sent on application to Professor A. T. Barnard. The courses are arranged to suit the needs of men who cannot attend college, and students receive individual attention.

Library

The Library contains 3,500 volumes and is available for students, missionaries, missionary societies and ministers.

Residence

Robertson College occupies at present three college houses in Edmonton South, purchased by the Board of Management and furnished by the efforts of the Women's Guild. Application for rooms for the session of 1915-16 should be made at once to Professor J. M. Millar, who should also be communicated with by those desiring calendars containing complete information about Robertson College.

During the session 1914-15, the number of students registered was 42. Of these 18 were taking matriculation work in preparation for the ministry. Most of the other students were taking both university and theological classes.

AFFILIATED PREPARATORY SCHOOLS

Under the regulations of the Senate, preparatory schools and colleges which send students to the University Matriculation Examinations are affiliated with the University.

Under this arrangement the following are affiliated institutions:

Western Canada College, Calgary.
Alberta College, Edmonton.
Robertson College, Edmonton.
Westward Ho! College, Edmonton.
Mount Royal College, Calgary.
The University School, Calgary.
Alberta College, (North), Edmonton.

STUDENT SOCIETIES

The Students' Union of the University of Alberta
Officers 1915-16

President	A. E. White
Vice-President	Miss Buchanan
Secretary	H. T. Beecroft
Treasurer	J. McPherson

The Gateway Staff, 1914-15

Editor-in-Chief	S. R. Hosford
Illustrations Editor	S. H. Thomson
Jokes Editor	F. G. Young
Lady Editor	Miss Cora Armstrong
Alberta College	Wm. Forshaw
Robertson College	M. S. Kerr
Literary Societies	H. R. Leaver
Athletics	G. Roy Stevens
Business Manager	G. S. Montgomery
Assistant Business Manager	H. Teviotdale
Circulation Manager	H. T. Beecroft

The Dramatic Society—Officers 1915-16

President	Mr. J. Adam
Vice-President	Miss G. Buchanan
Secretary	J. W. Markle
Treasurer	K. L. G. Bailey
Representative from the Faculty	Mr. S. Smith
Representative from the Senior Students	L. Jones
Representative from the Junior Students	Miss E. Hamilton

The English Club—Officers 1915-16

President	H. R. Leaver
Vice-President	Miss J. Stuart
Secretary-Treasurer	F. G. Young
Executive Committee	The Officers, Mr. Gordon, Miss B. Liesemer and N. A. Clark

The Philosophical Society—Officers 1915-16

Hon. President	Prof. Lewis
President	Prof Boyle
Vice-President	Mr. S. Smith
Secretary-Treasurer	Mr. J. Adam
Representative from Faculty	Mr. W. D. Woodhead
Representative from Students	J. L. Jackson

Rifle Association—Officers 1915-16

President	G. A. Cheeseman
Secretary	C. A. Young
Treasurer	J. W. Lewis
Senior Ordnance Officer	Mr. C. A. Robb
Executive Committee	The Officers, Dr. Fairley and E. F. W. Maunsell

Mathematical Club—Officers 1915-16

President	Mr. I. F. Morrison
Vice-President	Dr. Boyle
Secretary-Treasurer	Mr. H. J. McLeod
Executive Committee	The Officers, R. N. Parsons and G. Robinson

Modern Language Club—Officers 1914-15

President	Miss G. Tuttlle
Vice-President	H. C. Clark
Secretary	Miss M. B. McAllister

The Orchestra—Officers 1914-15

President	N. F. W. Graham
Secretary-Librarian	Miss E. M. Hayward
Treasurer	P. Anderson
Conductor	H. C. Graham

The Athletic Association—Officers 1915-16

President	L. B. Brown
Secretary	I. Parr

The Rugby Club—Officers 1915-16

President	F. A. Perraton
Manager	C. A. Buck
Captain	H. Beecroft
Secretary	W. E. James
Treasurer	J. R. Love

The Association Football Club—Officers 1914-15

President	J. A. Carswell
Manager	A. Wilson
Captain	

The Hockey Club—Officers 1914-15

President	R. Martin
Manager	R. P. Chubb
Captain	J. Parr

The Basketball Club—Officers 1914-15

President	L. B. Brown
Secretary and Manager	J. R. Love
Captain	Mr. W. M. Fife

The Wrestling and Boxing Club—Officers 1914-15

President	C. Reilley
Secretary	E. J. Van Petten
Wrestling Instructor	W. Manby

Tennis Club—Officers 1914-15

President	J. D. O. Mothersill
Secretary	R. G. Powell
Member of Executive Committee	Miss C. Pheasy

The Young Women's Christian Association Officers 1915-16

Hon. President	Mrs. E. W. Sheldon
President	Miss M. McAllister
Vice-President	Miss F. Henderson
Secretary-Treasurer	Miss H. Armstrong
Corresponding Secretary	Miss M. Wilson

The University Young Men's Christian Association Officers 1915-16

Honorary President	Dr. J. M. MacEachran
President	J. R. Love
Vice President	N. A. Clark
Treasurer	R. Sandin
Secretary	W. T. Knights
Chairmen of Committees:—	
University Service	K. Bailey
Extension Work	Jno. A. McLennan
Bible Study	W. T. Knights
New Student	Herman Trellé
Religious Work	L. L. Moore
Membership	W. E. James
Social	Angus Hutchinson

The Intercollegiate Young Men's Christian Association Officers 1915-16

President	J. L. Jackson
Vice President	C. Young
Recording Sec.	N. A. Clark
Student Secretary	M. W. Harlow
Chairmen of Committees:—	
Mission Study	W. Forshaw
Extension Work	C. Young
New Student	
University Service	N. A. Clark
Religious Work	N. D. McDonald
Bible Study	

The Students' Court—Officers 1915-16

Chief Justice	J. D. O. Mothersill
Senior Judge	H. A. Dyde
Junior Judge	G. S. Montgomery
Sheriff	A. Hutchinson

The Literary Society—Officers 1915-16

President	D. R. Thomson
Vice-President	J. W. Markle
Secretary	

The Glee Club—Officers 1914-15

President	C. F. Carswell
President for Women Students	Miss K. McCrimmon
Secretary-Treasurer	H. T. Beecroft
Secretary for Women Students	Miss B. Liesemer
Executive Committee	The Officers, Miss C. Armstrong, and R. B. Williamson

Women's Athletic Club—Officers 1914-15

President	Miss Buchanan
Vice-President	Miss C. Armstrong
Secretary	Miss K. McCrimmon
Executive Committee	Misses C. Pheasy, H. Barclay, R. Thompson, O. Devenish

The Wauneita Society—Officers 1915-16

Hon. President	Mrs. Race
President	Miss K. McCrimmon
Vice-President	Miss Cora Armstrong
Secretary-Treasurer	Miss B. Mitchell

Mining and Geological Society—Officers 1915-16

Hon. President	Prof. J. A. Allan
President	R. T. Hollies
Secretary-Treasurer	G. L. C. Kidd

The Track Club—Officers 1914-15

President	J. R. Love
Secretary	R. G. Powell

Students of the University of Alberta

ALPHABETICAL LISTS

A—Faculty of Arts and Sciences; S—Faculty of Applied Science; M—Faculty of Medicine; L—Faculty of Law; Ac.—Accountancy; P—Pharmacy.

The numbers refer to the year.

c—conditioned student; p—partial student; sp—special student; gr—graduate student.

Adam, J.	gr	A	Edmonton.
Ainlay, H. D.		A 2	Edmonton South.
Aldus, G. R.	sp	A 1	Doncaster, England.
Allen, Miss B. L.		A 3	Edmonton South.
Amey, Miss F.	sp	A 1	Cannington, Ont.
Anderson, Miss E. I.	c	A 2	Edmonton.
Anderson, E. L.		A 3	London, Ont.
Anderson, P. I.		A 2	Bardo, Alberta.
Annes, E. C.	c	S 3	Edmonton.
Appleton, S.		A 2	Harrow, England.
Archer, J.		L	Edmonton.
Armstrong, Miss C. F.		A 2	Edmonton.
Armstrong, Miss H. L. V.		A 2	Edmonton.
Atkinson, N. H.		S 1	Calgary, Alberta.
Aylen, C. K.		S 1	Fort Saskatchewan.
Aylward, J. W.		L 2	Pleasant View, P. E. I.
Backus, P. L.		M 1	Edmonton South.
Bailey, K. L. G.		A 2	Oak Bay, N. B.
Baker, G. L.	sp	A 1	Hespela, Ont.
Bainbridge, J. W.	p	A 1	Carlisle, England.
Ballentine, W. G.		Ac 1	Hamilton, Ont.
Barclay, Miss H.		A 4	Edmonton.
Barker, J. W.	sp	A 1	Bristall, Yorks, Eng.
Barron, J. B.		L	Calgary, Alberta.
Bassett, C. A.		P 1	Edmonton.
Batson, F. J.	p	S 3	Edmonton.
Beamish, E.	sp	A 1	Edmonton.
Beaty, W. M.		M 1	Calgary, Alberta.
Beck, C. L.		L 1	Edmonton.
Beecroft, H. T.		A 2	Edmonton.
Belcher, A. R.		A 1	Edmonton.
Bell, Miss C. M.	sp	A 2	Edmonton.

Bell, Miss E. I.	c	A	1	Edmonton.
Bell, R. C.		S	3	Macleod, Alberta.
Bellamy, R. V.		L	1	Edmonton.
Beresford, G. C.	c	A	1	Edmonton.
Berkov, A.		S	4	Calgary, Alberta.
Berry, W.		A	3	Edmonton.
Bird, H. S.		A	4	Amherst, N. S.
Bishop, W. T.		Ac		Edmonton.
Bissett, C. S.	c	A	2	Edmonton.
Blackmore, J.	gr	A		Raymond, Alberta.
Blain, L. K.		A	1	Edmonton.
Blue, N.		L	1	Edmonton.
Boness, O. C.		A	4	Kingman, Alberta.
Bosomworth, H .		A	4	Edmonton.
Bowles, A. W.	c	M	1	Biggar, Sask.
Bowman, Miss M. L.		A	1	Edmonton.
Boyaner, S. I.	c	A	3	Edmonton.
Boyd, H. A.		A	1	Larkhall, Scotland.
Boyd, J.		L	1	Medicine Hat, Alta.
Braman, E. J.	sp	A	1	Edmonton.
Bremer, Miss E. M.	c	A	1	Camrose, Alberta.
Bremner, C. C.		A	4	Red Deer, Alberta.
Bridges, E. C.		L	1	Calgary, Alberta.
Broad, P. D. S.		L	3	Calgary, Alberta.
Brooke, H.	sp	A	1	Toronto, Ont.
Brokovski, J. K.		L		Calgary, Alberta.
Brown, L. B.		S	3	Red Deer, Alberta .
Buchanan, Miss G.		A	3	Edmonton.
Buck, C .A.		S	3	Edmonton.
Butchart, H. T.		S	1	Edmonton.
Bury, A. C.		L	3	Edmonton.
Campbell, R. T.	c	A	1	Tyrone, Ireland.
Cantlon, W. R.	sp	A	2	Brussels, Ont.
Carmichael, Miss E. M.		A	3	Edmonton.
Carr, A. L.	gr	A		Nt. St. Eleanors P. E. I.
Carswell, C. F.		A	4	Red Deer, Alberta.
Carswell, J. A.		S	3	Red Deer, Alberta.
Casselman, F. C.		L	2	Edmonton.
Cheeseman, G. A.		M	2	Front Lake City, B. C.
Chubb, R. P.		S	2	Edmonton.
Clark, H. C.		A	4	Carrington, Allberta.
Clark, G. H.		A	1	Prescott, Ontario.
Clark, N. A.		S	2	Hazeldene, Chingford,

Clements, Miss L. R.		L	3	Vegreville, Alberta.
Coates, H.	sp	A	1	Yorkshire, England.
Cook, J. A.		S	2	Edmonton.
Coatsworth, J. R.	c	M	1	Ouvry, Ont.
Corbett, J. R.	sp	M	1	Edmonton.
Corbett, T. E.		P	1	Gull Lake, Sask.
Coulter, H. S.		L		Edmonton.
Cowper, A. D.	gr	A		Edmonton.
Craig, W. D.		L	2	Edmonton.
Crawford, L. H.	p	S	1	Edmonton.
Crosby, C. S.	sp	P	1	Wetaskiwin, Alberta.
Cross, Miss D.	sp	A	3	Toronto, Ont.
Cross, Miss M.	sp	A	2	Toronto, Ont.
Curtin, Miss A. A.	c	A	1	Kemptville, Ont.
Dafoe, E. F.		P	1	Edmonton.
Davies, J. A.	c	A	1	Edmonton.
Davis, J. J.		Ac		Surrey, England.
Day, F. G.		L	1	Martins, Alberta.
Dean, H. J.		L	2	Edmonton.
Devenish, Miss G.	c	A	2	Calgary, Alberta.
Devenish, Miss O.	c	A	1	Calgary, Alberta.
De Long, A. M.	sp	L	2	Calgary, Alberta.
Dickins, F. C.		A	2	Edmonton.
Dinning, H. H.		L	2	Calgary, Alberta.
Doze, J. S.	c	A	1	Beaver Hills, Alberta.
Drew, H. F.	sp	A	1	Edmonton.
Drysdale, J. R.		L	3	Clover Bar, Edmonton.
Duncan, J. E.		S	2	Edmonton South .
Duncan, A. F.		L	1	Monitor, Alberta.
Dyde, H. A.		A	3	Edmonton South.
Dymond, S. J.		A	4	Edmonton.
Edgar, J. E.		A	4	Newry, Ireland.
Edwards, D. S.	c	A	2	Edmonton.
Egan, I. S.		M	1	Calgary, Alberta.
Egbert, W. G.		L	2	Calgary, Alberta.
Elliot, W. A.		Ac		Edmonton.
Empay, H. S.		M	2	Edmonton.
English, J. L.		P	1	R. R. No. 1 Mull, Ont.
Erdman, Miss N.		A	2	Barons, Alberta.
Evans, R. W.		A	1	Coblenz, Sask.
Fairweather, J.	sp	A	2	Glasgow, Scotland.
Farrell, R.		P		Edmonton.
Ferguson, W. E.		M	2	Edmonton South.

Ferguson, S. C.	A 4	Edmonton.
Field, C. W.	sp M	Edmonton.
Fleming, F. E.	P	Edmonton.
Flint, C. D.	S 4	New Norway, Alberta.
Forshaw, W.	A 2	St. Helens, England.
Forster, R. P.	A 2	Edmonton South.
Franckum, J.	sp M	Edmonton.
Fraser, Miss C. B.	A 3	Sedgewick, Alberta.
Fraser, H. B.	L 1	Medicine Hat, Alberta.
Fulmer, Miss E. A.	A 4	Edson, Alberta.
Galbraith, F. P.	S 2	Red Deer, Alberta.
Gariepy, C. E.	L 3	Edmonton.
Garside, T. E.	L 1	Edmonton.
Geeson, J. R.	A 3	Grantham, England.
German, L. E.	c M 1	Edmonton.
Genik, J.	A 4	MacRorie, Sask.
Gibson, G. C.	A 1	Amisk, Alberta.
Gillespie, Miss A. M.	sp A 2	Edmonton.
Glanville, A. T. M.	L 1	Edmonton.
Gleason, J. M.	L 1	Edmonton.
Gordon, J. A.	L 2	Goderich, Ont.
Gould, R. W.	A 4	Okotoks, Alberta.
Graham, N .F .W.	A 4, M 2	Toronto, Ont.
Graham, G. E.	sp A 2	Bacup, England.
Graham, J.	sp A 1	Lewes, Scotland .
Gregory, J. H.	Ac	Edmonton.
Grierson, C. I.	gr S	Edmonton South.
Hager, B.	c M 1	Edmonton.
Hall, I. V.	M 1	Hughenden, Alberta.
Hallman, A.	S 4	Edmonton South.
Hamilton, Miss E. G.	A 2	Zetland, Alberta.
Hammond, A. M.	c L	Edmonton.
Hammond, J. R.	A 4, M 2	Edmonton.
Hankinson, C. H.	c M 2	St. Thomas, Ont.
Hanson, S.	M 1	Edmonton.
Harlow, M. W.	gr A	London, Ont.
Harper, G. W.	c A 1	Stavely, Alberta.
Harrison, J. D.	p S 1	Edmonton.
Harvie, J. G.	L 1	Calgary, Alberta.
Harvey, E. L.	L 3	Calgary, Alberta.
Hazelton, J. D.	L 4	Olds, Alberta.
Hayes, A. E.	A 3	Edmonton.
Heald, J. E. F.	sp A 2	Edmonton.

Henderson, E. F.	c	M	2	Hamilton, Ont.
Henderson, Miss C. F.		A	2	Edmonton.
Henry, R.	p	S	1	Edmonton.
Hewson, R. D.		M	2	Red Deer, Alberta.
Heywood, E.	sp	A	1	Colinton, Alberta.
Hickey ,Sr. M. L.		A	3	Edmonton.
Higgenbotham, E. C.	sp	P	1	Highland, Alberta.
Hill Miss E. M.		A	3, 3	Edmonton.
Hill, W. H.	c	M	1	Edmonton.
Hipkin, G. A.		A	4	Stickford, Boston, E.
Hollies, R. T.		S	3	Oak Lake, Manitoba.
Holmes, G. H.		A	4	Calgary, Alberta.
Hoover, E. R.	sp	A	1	Bittern Lake, Alta.
Horricks, H. M.	gr	A		Daysland, Alberta.
Hosford, S. R.		A	4	Edmonton.
Hotson, Miss H. J.		A	2	Edmonton.
Hotson, Miss J. I.		A	2	Edmonton.
Hotson, Miss J.	sp	A	1	Edmonton.
Hotson, Miss M. H.		A	3	Edmonton.
Howson, W. R.		A	4, L	Edmonton.
Huckell, F. C.		L	1	Edmonton.
Hurlburt, H. S.		L	1	Ontario.
Hustler, W. H.	c	M	2	Edmonton.
Hustler, G. F.		A	3	Edmonton.
Hutchinson, A.		A	2	Upr. Musquvdohoit,
Hyde, E. E.	g	A		Edmonton.
Ingpen, W. F.		L	3	Calgary.
Jackson, J. L.		A	4	Edmonton.
Jackson, R. C.		A	4	Ripley, Ontario.
Jacobs, Z. W.		L		Cardston, Alberta.
Jaffray, J. E.		S	3	Edmonton.
James, W. E.	c	S	1	Brampton, Ont.
Johnston, R. E.		A	2	Perivale, Ontario.
Jones, L.	c	A	1	Ponoka, Alberta.
Kelly, J. J.		L		Calgary, Alberta.
Kemp, H. C.		Ac		Edmonton.
Kernaghan, G. H.		S	1	Colchester, England.
Kerr, M. S.		A	3	Lamlash, Scotland .
Kidd, G. L.		S	3	Calgary, Alberta.
Kidwell, H. C.		Ac		Milford, Stratford, Eng.
Kinsey, H. A.		P	1	Edmonton.
Kirkpatrick, A. A G.	p	A	3	Kilrea, Ireland.
Knights, W. T.		A	2	Calgary, Alberta.

Knox, D. R.	sp	A	1	Tillicoultry, Scotland.
Knudson, R. G.	sp	A	1	Ponoka, Alberta.
Lailey, W. W.	sp	M		Edmonton.
Lanan, A.		L	2	Calgary, Alberta.
Larsen, C. L.		S	2	Yahk, B. C.
Lavalle, F.		M	1	Morinville, Alberta.
Lawlor, T. L.		L	1	Edmonton.
Lea, A. G.	sp	A	1	London, England.
Leach, J. F.		S	1	Vegreville, Alberta.
Leaver, H. R.		A	4	Aylesbury, England .
Leonard, S. C.		M	2	Bright, Ont.
Lewis, J. W.		S	2	Bon Accord, Alberta.
Libby, M.	gr	S		Edmonton.
Lieberman, M. I.		L	1	Edmonton.
Liesemer, Miss B. E.		A	3	Didsbury, Alberta.
Lillico, R. S. D.	sp	S	1	Ayr, Ontario.
Lincoln, A. G.		L		Calgary.
Lobb, Miss A. V.		A	3	Edmonton.
Lobb, Miss J. E.	p	A	3	Edmonton.
Locke, S. D.		M	2	Calgary.
Logan, H. T.		L	3	Edmonton.
Longmire, E.	sp	A	2	Hand Hills, Alberta.
Lonsdale, T. H.		A	2	Bacup, Lanc. Eng.
Loucks, J. E.	gr	A		Calgary, Alberta.
Love, J. R.	c	A	2	Irma, Alberta.
Low, A. W.		L	2	Calgary, Alberta.
Lund, T. F.	sp	A	2	Northumberland, Eng.
Lutz, R. C.	sp	A	1	Edmonton.
Lister, P. A. M.		A	1	Youngstown, Alberta.
McAllister, J. W.		A	2	Edmonton.
McAllister, Miss M.		A	3	Edmonton.
McAllister, T. H.	sp	A	1	Edmonton.
McArthur, N.	c	A	3	Edmonton.
McConnell, F. G.	c	A	3	New Westminster, B.C.
McConnell, H. F.		L	1	Edmonton.
McCrimmon, Miss K.	c	A	3	Edmonton.
McCuaig, S. H.		L	1	Bainsville, Ont.
McCubbin, J. B.	sp	A	1	Three Hills, Alberta.
McDonald, J. N.		S	3	Ohaton, Alberta.
MacDonald, L. S.		S	4	Peters Road, P. E. I.
MacDonald, K. J.		Ac		Baddeck, N. S.
MacDonald, P. A.	sp	M		Edmonton.
MacDonald, N. D.		A	4	Ponoka, Alberta.

MacDonald, W.		S	1	Ohaton, Alberta.
McDonald, W. S.		S	4	Embro, Ont.
McElwee, J. A.	sp	S	1	Derby Junction, N. B.
McGuire, J. B.		L		Calgary, Alberta.
McInnis, W. A.		S	3	Edmonton.
McKay, P.	c	M	1	Grande River, N. S.
McKay, W. A.		A	2	Calgary, Alberta.
McKenna, F. O.		L	1	Bankhead, Alberta.
McKenzie, W. J.		A	3	Mitchells Bay, Ont.
McKenzie, J. A.		L	2	Edmonton.
McKinney, J. W.		A	2	Claresholm, Alberta.
McKittrick, E. S.		S	2	Edmonton.
McKnight, A. L.	gr	A		Fredericton, N. B.
McLachlan, A. H.		L	1	Edmonton.
MacLean, M. M.		A	3	Ullapool, Scotland.
McLellan, W. J.		S	2	Edmonton.
MacLeod, H. J.	gr	S		High River, Alberta.
MacLennan, J. A.		A	3	Edmonton.
McMillan, Miss C. J.		A	2	Edmonton.
McNally, P. B.		M	2	Edmonton.
McNamara, Miss C.	c	A	2	Edmonton.
McNamara, Sr. A. B.	sp	A	3	Edmonton.
McNaught, D. H.	c	A	2	Edmonton.
McNeill, W.		S	1	Edmonton.
McPherson, J.		A	3	Coalhurst, Alberta.
McQueen, A. R.		A	1	Edmonton.
McQueen, R.		S	2	Edmonton.
MacRae, D. A.	sp	M	1	Lancaster, Ont.
McTaggart, J. W.		Ac		Alvinston, Ontario.
Mainman, J. V.		A	2	Edmonton,
Margoll, W. S.	sp	A	2	Canton, China.
Markle, C. G.	c	S	2	Red Deer, Alberta.
Markle, J. W.		A	2	Edmonton.
Martin, R. H.	sp	A	2	Viking, Alberta.
Martin, Miss G. J.		A	2	Edmonton.
Martin, R. M.		S	4	Edmonton.
Maunsell, E. F. W.		S	2	Macleod, Alberta.
Maxwell, G. A.		Ac		Edmonton.
Metcalfe, A. E.		A	3	Edmonton.
Middlleton, W. T.		S	2	Victoria, B. C.
Might, A. E.	c	A	2	Edmonton.
Might, O. H. E.		L	2	Calgary, Alberta.
Miller, L. V.		S	2	Edmonton.

Miller, L. E.		M	1	Warsau, N. Y.
Miller, T. C. M.		Ac		Edmonton.
Minish, N. J.		M	1	Viscount, Sask.
Mitchell, D.		Ac		Edmonton.
Mitchell, Miss I. B.	c	A	1	
Montgomery, Miss H. B.	sp	A		Edmonton.
Montgomery, G. S.		A	2	Edmonton.
Möller, C. C.		L	2	Edmonton.
Moore, L. L.		A	2	Jarrow, Alberta.
Moraw, Miss K.	c	A	2	Edmonton.
Morrish, W.		M	2	Shrewsbury, England.
Morrison, W.	c	A	1	Okotoks, Alberta.
Morse, W. H.		Ac		Nova Scotia.
Mothersill, J. D. O.		A	3	Brampton, Ontario.
Moyle, W. D.	sp	S	2	Toronto, Ontario.
Newland, H. C.	gr	A,	L	Vegreville, Alberta.
Nidrid, Miss F. S.	c	A	1	Mound, Alberta .
Nightingale, J. W.	sp	A	2	Greenwich, England.
Novak, G.	c	M	2	Model, Farm, Sask.
Occomore, F. S.	c	M	1	Calgary, Alberta.
Ottewell, A. E.	gr	A		Edmonton.
Palmer, C.	c	M	1	Edmonton.
Palsen, G.	sp	S	2	Reykjavik, Iceland.
Parker, J.		A	2	Wiltshire, England.
Parr, J. R.	c	A	2	Castor, Alberta.
Parry, R. H.	sp	A	2	Yorks, England.
Parsons, Miss G. C.	sp	A	1	Vermilion, Alberta.
Parsons, E. H.		A	4	Edmonton.
Patterson, G. E.		A	3	Sussex Corner, N .B.
Pearce, H. W.	c	A	1	Owosso, Mich.
Perraton, F. A.		A	3	Passedean, California.
Peters, H.	sp	A	1	Buckley, North Wales.
Pheasey, Miss C. M.		A	3	Edmonton.
Pike, S.	sp	A	2	Norfolk, England.
Poaps, W. B.		A	3	Edmonton.
Pollard,, W. C.		L		Calgary, Alberta
Popple, A. E.		L	4	Wetaskiwin, Alberta
Powell, R. G.		A	3	Taber, Alberta.
Priesley, N. F.		A	3	Edmonton.
Proud, W. A.	sp	M		Edmonton.
Purvis, C. G.		L	3	Edmonton.
Quance, F. M.	gr	A		Gadsby, Alberta.
Richard, R. P.		L	1	Edmonton.

Rielly, C. F.		S	3	Calgary, Alberta.
Riddell, H. G.		A	3	Edmonton.
Riopel, J. H.		M	2	Morinville, Alberta.
Ritchie, A. D.	sp	M		Edmonton.
Ritchie, G.	sp	A	2	Edmonton.
Roach, T. F.		L		Calgary, Alberta.
Robinson, G.		A	4	Leeds, England .
Robinson, A .E. F.	c	S	1	Paris, Ontario.
Robinson, H. B.		L		Calgary, Alberta.
Ronning,, C. A.	sp	A	1	Grande Prairie, Alberta.
Rockwood, M.	c	A	1	Hornchurch, Essex, E.
Roscoe, Miss H. M.	p	A	2	Springhill, N. S.
Russell, P. H.		L		Medicine Hat, Alberta.
Rutherford, Miss H.	sp	A	2	Edmonton.
Rutherford, C.		L	3	Edmonton.
Sander, G. A.	sp	A	1	Hespler, Ontario.
Sandercock, W. R.		L	1	Calgary, Alberta.
Sandin, R. B.		A	3	Wetaskiwin, Alberta.
Schofield, C.	sp	A	3	Nelson, England.
Schroter, Miss C. M.	c	A	2	Bremner, Alberta.
Sells, F. C.		L	1	Edmonton.
Sereth, G.		A	1	Calgary, Alberta.
Seyer, W. F.		A	4	Botha, Alberta.
Sheane, G. K.		A	4	Edmonton.
Sheppard, R. S.	gr	A		Belhaven, Ontario.
Shink, G. H.		L	2	St. Joseph of Levis, Q.
Simons, R. / .	sp	A	2	Bradfield, Essex, Eng.
Simmons, F. W.		A	2	Coventry, England.
Simpson, A. S.		S	2	Innisfail, Alberta.
Skarin, Emil.		S	1	Calgary, Alberta.
Skarin, Mrs. E.	sp	A	2	Calgary, Alberta.
Skene, E. A.		A	1, L	Calgary, Alberta.
Skouson, D. P.	c	A	2	Raymond, Alberta.
Slaughter, R. H.		S	2	Bentley, Alberta.
Smith, Miss D. C.		A	1	Edmonton.
Smith, Miss M. M.		A	4	Lethbridge, Alberta.
Smith, M. N.		A	1	Edmonton,
Smith, W. L.		A	4	Delbourne, Alberta.
Smith, D. R.		S	1	Edmonton.
Smith, W. F.	sp	A	2	Caldwell, Quebec.
Sneddon, T.	c	A	2	Rutherglen, Scotland.
Snooke, I.	sp	A	3	Fortune, Nfld.
Soltau, W. G.		L	2	London, England.

Southworth, W.		P	1	Dusseldorf, Alberta.
Speers, R. W.		L	2	Edmonton.
Stainton, J. T.		A	2	St. Marys, Ontario.
Stenhouse, Miss J. I.	gr	A		Raymondp, Alberta.
Stevens, G. R.		A	4	Edmonton.
Stewart, Miss G. A.	c	A	1	Minnedosa, Manitoba.
Stewart, Miss J. C.	c	A	1	Minnedosa, Manitoba.
Stover, M.		A	2	Edmonton.
Stover, H .R.	sp	M	1	Edmonton.
Stow, H. F.		L	3	Calgary, Alberta.
Stuart, Miss J. M.		A	3	Edmonton.
Suttill, J. P.		A	2	Yorkshire, England.
Switzer, M. C.		P	1	Lacombe, Alberta.
Sykes, W.		A	2	Yorkshire, England.
Talbot, A.	c	A	1	Lacombe, Alberta.
Taylor, W. J.		S	1	Calgary, Alberta .
Taylor, H. T.		A	4	Edmonton.
Taylor ,F. H.	sp	S	2	St. George, Ontario.
Taylor, R. C.	p	A	2	Morinville, Alberta.
Taylor, T.	sp	A	3	Edmonton.
Telfer, D. H.	gr	A		Edmonton.
Teviotdale, D. J.		A	2	Edmonton.
Thatcher, Miss M. A.	p	A	1	Columbia Valley, B. C.
Thomson, D. M.		A	2	Edmonton.
Thomson, J. R.	sp	A	1	Perth, Scotland.
Thomson, Miss R.		A	1	Edmonton.
Tiffin, M. E.		M	2	Lethbridge, Alberta.
Townsend, F. E.	c	M	1	Kinsella, Alberta.
Trelle, H. T.	c	S	1	Lake Saskatoon, Alta.
Turgeon, C. O.		L	3	Edmonton.
Tuttle, Miss G. M.		A	4	Edmonton.
Urquhart, L .L.	c	M	1	Edmonton.
Valens, A. W.		M	2	Lamont, Alberta.
Valiquette, J. A.		L	2	Calgary, Alberta.
Van Allan, G. H.		L	3	Edmonton.
Van Petten, E. J.		A	3	Camrose, Alberta.
Wadleigh, W. W.	gr	A		Edmonton.
Walker, E .C.	c	A	1	Edmonton.
Walsh, L. A.		L	1	Calgarp, Alberta.
Walton, R. A.	c	M	2	Ft. Saskatchewan, Alta.
Ward ,C. A.	A	2,	M	Edmonton.
Way, V. E.		L	1	Edmonton.
Weir, Miss C. F.	c	A	2	Lougheed, Alberta .

Wells, T. H.		L 1	Edmonton.
Westberg, R. E.		S 2	Seattle, Washington.
White, A. E.		A 3	Edmonton.
White, H. A.		A 3, L 2	Edmonton.
Williams, R. F.	gr	A	Okotoks, Alberta.
Williamson, R. V.		S 2	Maple Creek, Sask.
Wilson, C. B.		A 2	Dundar, Scotland.
Wilson, H. J.		A 4	Edmonton.
Wilson, Miss M. J.		A 1	Edmonton.
Wilson, T. J.		A 4	Edmonton.
Wilson, A. R.	c	A 1	Edmonton.
Wilson, J. K.		L 2	Edmonton.
Wilfield, E. H.	sp	A 1	Edmonton.
Won Bing	c	S 1	Canton, China.
Young, C.		A 3	Springbank, Alberta.
Young, B.	sp	A 1	Mattock, Derbysh. Eng.
Young, F. G.		A 4	Lacombe, Alberta.
Young, M. A. R.	c	M 1	Edmonton.

EXAMINATION STANDING

The following are the results of the final examinations in the University. The students are grouped by classes, the first class comprising those who have obtained eighty-five per cent and over, the second class those who have obtained between sixty-five and eighty-four per cent and the third class those who have obtained between fifty and sixty-four per cent.

CHRISTMAS FINALS, 1914-15.

FACULTY OF ARTS AND SCIENCES

Mathematics 1 (a)—Geometry

Class I. Rookwood.

Class II. Miss G. Stewart; Ronning; Miss Bowman and Teviotdale, equal; Lyster and Poaps, equal; Miss Hamilton; Belcher; J. R. Thomson; Miss Mitchell; G. H. Clark; Knudson and Miss Moraw, equal.

Class III. Appleton and Lutz and Miss Wilson, equal; Miss Curtin and Miss Fulmer and Miss D. C. Smith and Miss Thomson, equal; Miss Bremner and Walker, equal; Miss Martin and Miss J. Stewart ,equal; Miss Henderson and Hoover, equal; A. E. F. Robinson; Evans; Drew; Beresford and Graham and Talbot, equal.

Mathematics 7 (a)—Solid Geometry

Class I. Sister Hickey; McNaught.

Class II. Hutchinson.

Class III. Miss H. J. Hotson; Miss McMillan; Evans; Miss Weir; Knudson.

FACULTY OF APPLIED SCIENCE

Botany 2

Class II. McInnes.

Class III. Bell and Jaffary, equal.

Civil Engineering 2 (Mapping)

Class I Cook and L. V. Miller, equal; Clark and Chubb, equal.
Class II. C. G. Markle; Palsen; McLellan and Slaughter, equal; McKittrick and McQueen, equal; Westberg; Galbraith; Williamson; Middleton.
Class III. J. E. Duncan.

Civil Engineering 51 (Advanced Structures)

Class I. W. S. McDonald.

Civil Engineering 53 (Framed Structures)

Class II. Batson; Brown; Hallman.
Class III. J. A. Carswell; J. N. McDonald; Jaffary, Buck.

Civil Engineering 56 (Hydraulic Machinery)

Class II. Flint; Hallman.
Class III. Berkov.

Civil Engineering 60 (Astronomy)

Class II. Brown; J. A. Carswell; Buck.
Class III. McDonald; Jaffary.

Civil Engineering 58 (Mapping)

Class I. Buck.
Class II. J. A. Carswell and McInnes, equal; Jaffary; Brown and J. N. McDonald, equal.

Civil Enginering 63 (Structural Design)

Class I. W. S. McDonald.
Class II. L. S. MacDonald; Berkov; Flint.
Class III. Hallman; Martin.

Civil Engineering 65 (Testing Laboratory)

Class I. Kidd.
Class II. Buck and Hollies, equal; McInnes; Reilly; Brown and J. N. McDonald, equal; J. A. Carswell and Jaffary, equal.
Class III. Bell.

Civil Engineering 67 (Theory of Structures)

Class II. Hollies.
Class III. Kidd.

Drawing 1 (Geometrical Drawing)

Class I. Trelle; Atkinson; McNeill; W. J. Taylor.
Class II. Aylen.
Class III. Miss Hill; Lillico; A. E. F. Robinson; Leach.

Mathematics 1 (a) (Geometry)

Class II. McNeill; Henry.
Class III. A. E. F. Robinson.

Mathematics 4 (Geometry)

Class I. Atkinson.
Class II. R. McQueen; Butchart; W. J. Taylor; Trelle.
Class III. Skarin.

Mathematics 10 (Analytical Geometry)

Class I. Cook.
Class II. N. A. Clark; Slaughter; Lewis; Westberg.
Class III. McLellan; Galbraith; McKittrick; L. V. Miller; Larson.

Mathematics 54 (Mechanics)

Class II. J. N. McDonald; Hollies; Jaffary.
Class III. Buck and McInnes, equal; Brown; J. A. Carswell; Reilly.

Mining Engineering 54 (Assaying)

Class II. Kidd; Hollies.
Class III. Annes and Lewis ,equal; Reilly.

Physics 2

Class II. Atkinson; Trelle; W. J. Taylor; McNeill; Harrison.
Class III. Miss Hill and Lillico, equal; Butchart; Skarin and Leach, equal; W. McDonald .

FACULTY OF MEDICINE

Bacteriology

Class I. Locke; Hewson and Morrish and Tiffin, equal; Empay.

Class II. Walton; Leonard; Valens; Hammond and N. F. W. Graham, equal; McNally; Cheeseman; Riopel; W. E. Ferguson and Novak, equal.

Botany 2

Class II. Minish; Backus; Hanson and Riopel, equal; Occomore; H. R. Stover; Novak and German, equal; Bowles.

Class III. Hill; Townsend; Urquhart; Lavallee; MacKay; L. E. Miller.

Chemistry 2

Class I. Townsend.

Class II. Minish; L. E. Miller and Ward, equal; Hanson; Backus; J. R. Corbett.

Class III. Hill; Bowles; Occomore; German and Palmer, equal.

DEPARTMENT OF PHARMACY

Chemistry 2

Class II. T. E. Corbett.

Class III. English; Higginbotham; Crosby and Fleming and Switzer and Bassett, equal.

FINAL EXAMINATIONS

FACULTY OF ARTS AND SCIENCES

Botany 1.

Class I. N. M. Stover.

Class II. Miss J. I. Hotson.

Class III. Harper.

Botany 51.

Class I. McLennan.
Class II. Miss A. Lobb.
Class III. Miss M. Hotson.

Botany 52.

Class I. Miss Tuttle and Seyer, equal.

Chemistry 1.

Class I. N. M. Stover.
Class II. Miss E. Hamilton and Miss H. Hotson, equal.
Class III. Miss J. I. Hotson; Miss Barclay.

Chemistry 2 (Arts, Special)

Class II. McKinney.

Chemistry 51.

Class III. McArthur.

Chemistry 54.

Class I. Seyer.

Chemistry 102.

Class I. Seyer.

Economics 51.

Class I. Sandin; Dyde.
Class II. Bremner; Howson; J. L. Jackson; E. L. Anderson and Miss Liesemer and Perraton and Miss M. Smith, equal; McLennan; Miss Fraser; C. F. Carswell.
Class III. Patterson and Priestley, equal; Van Petten; A. E. White; Miss Barclay; H. White; Stevens; Miss Buchanan; Miss M. Hotson; Genik; Miss McAllister.

Education 51.

Class I. S. C. Ferguson; Sandin; J. L. Jackson.

Class II. Boness and H. J. Wilson, equal; Miss Carmichael; Bird and W. L. Smith, equal; F. G. Young; Dymond; Stevens; Miss A. Lobb and N. D. MacDonald, equal.

Class III. Miss McCrimmon; R. C. Jackson and T. J. Wilson, equal; Poaps; Miss Allen; Genik and Parsons, equal; H. Taylor.

English 1.

Class I. Boyd.

Class II. Heywood; Miss J. Stewart; Brooke; Bainbridge; Miss G. Stewart and Miss Bowman, equal; Jones; Peters; Miss D. C. Smith.

Class III. G. H. Clark; Coates; D. Young and Lyster, equal; Rookwood; McCubbin and Evans and Beamish, equal; Sander and Miss O. Devenish and Knox and Miss Mitchell, equal; Miss Bremner and Braman and Campbell and T. H. McAllister and Knudson and Blain, equal; Miss Thomson and Nightingale and Miss Curtis, equal; Aldus and G. L. Baker and Lea and Miss E. I. Bell, equal; Skene and Winfield, equal; A. R. Wilson; Miss Wilson and Beresford and Harper and Belcher, equal.

English 2.

Class I. J. W. Markle.

Class II. Montgomery; Powell; Bailey and McNaught, equal; Bissett; P. I. Anderson and Miss H. Hotson and Poaps, equal; Knights; J. R. Thomson; McKinney and D. M. Thomson, equal; Teviotdale; Ainlay.

Class III. Forster; Miss G. Devenish; J. W. McAllister; Miss J. I. Hotson; Miss C. Armstrong; Ritchie and Suttill, equal; G. E. Graham and Love, equal; Miss Hamilton; Hutchinson and Miss McCrimmon, equal; Johnston and Miss McMillan and Miss Moraw, equal; Beecroft and A. R. McQueen and Might and Simmons and Ward, equal.

English 51.

Class I. Kerr.
Class II. Sheane; Sr. Hickey; Geeson; Sr. McNamara; Miss Buchanan; Miss J. Stuart; McPherson and Miss Carmichael, equal; Forshaw; McLennan and Patterson, equal.
Class III. Priestley and Miss Fraser, equal; Miss Liesemer.

English 52.

Class I. Leaver; Bosomworth and Hosford, equal.
Class II. E. G. Anderson; F. G. Young; Stevens; Hipkin; Miss M. Smith; Mothersill and Miss Tuttle, equal; N. D. McDonald and T. Taylor, equal; Miss McAllister.
Class III. McArthur; Miss Pheasey; C. Young; Parsons and H. Taylor, equal.

English 102.

Class I. Hosford.

French A.

Class I. Miss J. Hotson; McNaught.
Class II. Rookwood; Miss E. I. Bell; Miss J. Stewart; Miss G. Stewart; Ronning.
Class III. A. R. Wilson; L. Jones; Miss Bremer; Walker.

French 1 (Authors)

Class I. McKinney.
Class II. Miss Bowman; Forshaw and Miss D. Smith, equal; P. I. Anderson; Miss O. Devenish; Miss M. Wilson; Miss R. Thomson.
Class III. Miss F. Henderson; Blain and G. F. Hustler, equal; Miss G. Martin; Belcher; Miss Curtin and Mrs. Skarin, equal; A. R. Wilson; Miss Allen and Beresford and Miss Niddrie and Parr, equal.

French 1 (Prose)

Class I. Miss M. Wilson.

Class II. Van Petten; Miss Bowman and Miss O. Devenish and McKinney and Miss D. Smith, equal; P. I. Anderson; A. R. Wilson; Forshaw; Perraton; Miss Thomson; Blain; Harper.

Class III. Belcher and Miss Niddrie, equal; G. F. Hustler; Mrs. Skarin; Miss Curtin; Beresford.

French 2 (Authors)

Class I. J. W. Markle; D. M. Thomson; Montgomery.

Class II. Miss C. Armstrong; Bailey; Miss H. Hotson and Miss J. I. Hotson, equal; J. W. McAllister; Hutchinson and Ward, equal; Ainley; Miss Roscoe; S. C. Ferguson and Powell, equal; Moore; Miss Moraw.

Class III. Miss G. Devenish and N. M. Stover, equal; Miss E. I. Anderson; Dickens and Miss Erdman and Miss Schroter, equal; W. A. McKay.

French 2 (Prose)

Class I. J. W. Markle; Bailey.

Class II. Montgomery and J. W. McAllister, equal; D. M. Thomson; Perraton; Miss H. Hotson and Miss Moraw, equal; Miss C. Armstrong; W. A. McKay; Hutchinson; Powell; Miss J. I. Hotson; Miss Roscoe; Miss G. Devenish and Ward, equal; N. M. Stover.

Class III. S. C. Ferguson and Miss Schroter, equal; Ainlay; Miss McCrimmon; Miss E. I. Anderson; Miss Erdman and Van Petten, equal; Dickens; Moore; Miss Henderson.

French 51.

Class I. Sr. Hickey and Sandin, equal.

Class II. H. C. Clark; C. F. Carswell; Miss Fraser; Sr. McNamara; Miss J. Stewart; Miss Tuttle.

Class III. Miss Carmichael; Miss McAllister; Miss M. Smith; N. F. W. Graham (Comp. only); Miss Pheasey.

French 102.

Class II. H. C. Clark.

Geology 51.

Class I. Sandin; McLennan; Edgar.
Class II. Howson; McPherson; Bosomworth; Perraton; Miss Fraser; E. L. Anderson; McKenzie.
Class III. Poaps; N. D. MacDonald; Miss McAllister; Seyer; Miss Carmichael; Ainlay; Bird; Miss Fulmer; Mothersill; C. Young; Miss J. Stuart; Hipkin.

Geology 53.

Class I. Bremner.
Class II. Stevens; Genik.

German A.

Class III. Miss Schroter.

German 1 (Authors)

Class I. Berry; Rookwood.
Class II. Ronning; Evans; Knudson.
Class III. Sereth; Pearce; Miss O. Devenish; Miss Henderson; R. C. Jackson.

German 1 (Prose)

Class II. Berry; Rookwood; Evans; Ronning.
Class III. Teviotdale; Knudson; Pearce; Miss O. Devenish and J. Doze and Gibson and Miss Henderson and R. C. Jackson, equal.

German 2 (Authors)

Class II. P. I. Anderson; J. W. Markle; Miss J. Hotson and Dyde, equal; Miss H. J. Hotson; Miss C. Armstrong; Mrs. Skarin.
Class II. Miss Liesemer; Miss Hamilton; Teviotdale; Miss M. Hotson and Miss McMillan and Miss H. Armstrong and Beecroft, equal.

German 2 (Prose)

Class I. P. I. Anderson.
Class II. J. W. Markle; Miss J. Hotson; Mrs. Skarin and Miss C. Armstrong equal; Miss H. J. Hotson; Dyde; Miss Hamilton.
Class III. Miss Liesemer; Miss M. Hotson and Miss H. Armstrong and Beecroft and Miss McMillan, equal.

German 52.

Class II. H. C. Clark; Boness; Miss Tuttle.

Greek A.

Class II. G. H. Clark.

Greek 1 (Authors)

Class II. MacLean; Lyster; J. R. Thomson; Kerr.
Class III. T. H. McAllister.

Greek 1 (Prose)

Class II. MacLean.
Class III. Lonsdale.

Greek 2 (Authors)

Class II. Sykes; Berry; Forshaw.
Class III. Stainton; Sneddon; McKenzie; Suttill.

Greek 2 (Prose)

Class III. Geeson; Suttill; Forshaw; Sykes and Berry, equal.

Greek 51.

Class I. Holmes; Hosford; Quance.
Class II. Edgar.

Greek 101 (a)

Class I. Holmes.
Class II. Quance.

Greek 101 (b)

Class I. Holmes.
Class II. Quance.

Hebrew 51.

Class II. Kirkpatrick.
Class III. McKenzie; Kerr.

History 1.

Class I. Bainbridge and T. H. McAllister, equal; Ronning and Rookwood, equal; Miss Bowman; J. Graham; Beamish and Blain and Miss D. C. Smith and Miss G. Stewart and Miss J. Stewart, equal; Boyd; Knox and Morrison, equal.

Class II. G. H. Clark and Lyster and Moore, equal; Miss Curtin and Evans and Jones and A. R. Wilson and Miss Bremer, equal; Miss E. I. Bell and Campbell and Miss Mitchell, equal; Barker; Beresford and Pearce and G. F. Hustler, equal.

Class III. J. Doze and Mrs. Skarin and Talbot and Miss Thomson and Miss O. Devenish, equal; Belcher; Skene and Lillico, equal.

History 2.

Class II. Patterson; McNaught; Montgomery; Forster; Bailey; McKinney; Miss C. Armstrong and Teviotdale, equal; Hutchinson and Knights, equal; Miss Tuttle; Powell; J. W. McAllister.

Class III. A. R. McQueen; Anderson and Bissett and Miss Fulmer, equal; Lonsdale and Miss Hamilton and Miss A. Lobb, equal; Miss G. Devenish; Love; Moore; Miss McMillan and Sykes, equal; D. M. Thomson; Miss Roscoe and Stainton, equal; Might.

Aeg. Middleton.

History 54.

Class I. Berry.

Class II. E. L. Anderson; Howson; Sheane; Miss Liesemer; Kerr.
Class III. R. C. Jackson; N. D. MacDonald and Sneddon, equal.

History 56.

Class II. H. J. Wilson; W. L. Smith; Sheane.
Class III. Sr. McNamara and R. C. Jackson, equal; Sr. Hickey; Miss Barclay; T. J. Wilson.

History 57.

Class II. Mothersill; C. F. Carswell and S. C. Ferguson, equal.
Class III. Powell; McPherson; H. White; Van Petten; A. E. White.

History 58.

Class II. H. J. Wilson; McPherson; Perraton.
Class III. Mothersill; Dymond; A. E. White; W. L. Smith; T. J. Wilson; C. F. Carswell; F. J. Young.

Latin A.

Class I. Miss Mitchell.
Class II. Miss G. Stewart; Miss J. Stewart; L. Jones.
Class III. Edwards; Pearce; Miss E. I. Bell.

Latin B.

Class III. Harper; Drew; T. H. McAllister.

Latin 1 (Authors)

Class II. Miss Bowman; Miss D. Smith; Sandin; McNaught; Evans and Lonsdale, equal; Poaps and Stainton, equal.
Class III. E. L. Anderson and Knox, equal; Lyster; G. H. Clark and Forster, equal; Belcher and Miss McAllister, equal; Miss Roscoe; Blain and Braman and Boyaner and Miss R. Thomson and Johnston, equal.

Latin 1 (Prose)

Class I. Sandin.

Class II. Evans; McNaught; Miss Bowman; Miss D. Smith; Braman; Miss Niddrie; Knox.

Class III. Miss Hamilton; Ainlay; Lyster; R. E. Johnston; Miss McAllister; Blain; Powell; E. L. Anderson and Belcher and Boyaner and Forster and Sneddon and J. R. Thomson and N. Graham and Stainton, equal.

Latin 2 (Authors)

Class I. Montgomery; McKinney.

Class II. Bailey; Sykes; Suttill; J. W. McAllister; D. M. Thomson; Ainlay.

Class III. Miss Barclay; Knights; Ward; Miss Erdman and Miss G. Devenish, equal.

Latin 2 (Prose)

Class I. Suttill; Montgomery.

Class II. McKinney.

Class III. Ward; Sr. McNamara; Sykes; D. M. Thomson; Miss Barclay and Bailey, equal; Lonsdale; Knights; Miss H. Armstrong and Miss G. Devenish, equal.

Latin 51.

Class I. Holmes.

Class II. Edgar.

Class III. Miss Buchanan; MacLean; Miss J. Stuart.

Latin 101.

Class I. Holmes.

Class II. Edgar.

Mathematics 1 (b)
(Algebra only)

Class II. Sandin.

Class III. Hoover; J. W. Markle.

Mathematics 1 (b) and (c)
(Algebra and Trigonometry)

Class I. Rookwood.
Class II. Miss G. Stewart; Forshaw and Miss Mitchell and N. M. Stover ,equal; Miss D. C. Smith; Knudson; Davies and Lyster, equal; G. H. Clark and Ronning, equal; Miss Bowman; Miss Curtin; Stainton; Miss Bremer.
Class III. Miss J. Stewart; Evans; Belcher and Drew, equal; Beresford; Walker and Miss G. Martin and Hipkin and Parsons, equal.

Aeg. Talbot.

Mathematics 1 (c)
(Trigonometry only)

Class I. Johnston; C. B. Wilson; Miss Erdman.
Class II. Hutchinson; Berry; Miss Fulmer and Priestley and Miss Thatcher, equal.

Mathematics 7 (b)
(Algebra)

Class I. Sr. Hickey.
Class II. McNaught; Miss H. Hotson.
Class III. Hutchinson; Love; Knudson; Evans; Miss McMillan.

Mathematics 51.

Class I. Dymond.
Class III. Van Petten.

Mathematics 52.

Class I. Cowper.
Class III. A. E. White.

Mathematics 53.

Class I. Shaene; Geo. Robinson.
Class II. Patterson; Priestley; D. M. Thomson.
Class III. H. White; Miss Barclay.

Mathematics 101.

Class I. Cowper; Geo. Robinson.

Mathematics 102.

Class I. Geo. Robinson; Cowper.

Philosophy 1.

Class I. Boyd and Lonsdale, equal; Bailey; Montgomery; Ainlay and J. W. Markle and Simons, equal; J. W. McAllister; Miss C. Armstrong and Dymond, equal.

Class II. P. I. Anderson; Sneddon; Sykes and Teviotdale, equal; Miss Erdman and Knights, equal; G. E. Graham and Johnston and Ritchie, equal; Miss Roscoe and D. Young, equal; Winfield; Might and Parry, equal.

Class III. W. A. McKay; Forster; C. B. Wilson; Miss C. M. Bell and Moore, equal; Miss Rutherford; Beecroft and D. M. Thomson, equal; Lund; Miss F. Henderson; Heald and W. F. Smith, equal; Dickins; Miss E. I. Anderson; Suttill; Cantlon and Skouson, equal.

Philosophy 51.

Class I. Geeson; Dyde.

Class II. F. G. Young; Priestley; W. L. Smith; Miss Fulmer and Patterson, equal; Perraton; Schofield.

Class III. Mothersill; Miss Barclay; Bird and MacKenzie, equal; Longmire; T. J. Wilson; Miss A. Lobb.

Philosophy 52.

Class I. Berry and Leaver, equal; J. L. Jackson; Bosomworth.

Class II. Howson; Boness; Harlow.

Class III. R. C. Jackson; Hayes; Hipkin; T. Taylor; H. Taylor.

Philosophy 101.

Class I. Dyde; Geeson.

Philosophy 102.

Class I. Leaver.

Physics 1 (a)

Class I. Miss Bowman.
Class II. Miss D. C. Smith; Miss G. Stewart; Miss Mitchell.
Class III. Evans; Rookwood and Miss J. Stewart, equal; Forshaw and Knudson, equal; Ronning; Bainbridge and Miss Curtin and Lonsdale, equal; Beresford; Miss Niddrie; Blain and Lyster, equal; G. H. Clark and Miss Erdman and Miss Thatcher and Jones, equal; Talbot and Miss Wilson and Campbell and Sykes, equal.

Physics 52.

Class III. Dymond.

Physics 52 Laboratory

Class II. Dymond.

Physics 54.

Class II. Bremner.
Class III. Van Petten; H. C. Clark.

Physics 54 Laboratory.

Class II. Bremner and H. C. Clark, equal.
Class III. Van Petten.

Psychology 51.

Class I. S. C. Ferguson; J. L. Jackson; Bremner and Leaver and Miss M. Smith, equal.
Class II. Hosford; Miss Liesemer and G. Robinson, equal; Harlow; Boness; Miss J. I. Hotson.
Class III. Hayes; Miss C. M. Bell; Miss McCrimmon.

FACULTY OF MEDICINE

Gross Anatomy.

Class II. Valens; Hammond; Morrish; Tiffin; Hewson; Leonard; Locke and McNally, equal.

Class III. W. E. Ferguson; Cheeseman and Walton, equal; N. F. W. Graham; Empay.

Histology and Splanchnology.

Class II. Valens; McNally; Locke; Walton; Hammond and Morrish, equal; Hewson; N. F. W. Graham.

Class III. Leonard and Tiffin, equal; W. E. Ferguson; Cheeseman, Empay.

Embryology.

Class II. Valens; Hammond and Locke, equal; Morrish; Hewson; Tiffin; McNally.

Class III. Leonard; Walton; Cheeseman; N. F. W. Graham.

Chemistry 3.
1st Y. Med.

Class I. Ward.

Class II. Townsend.

Class III. J. R. Corbett; Minish; Hanson; L. E. Miller; Bowles; Backus; Occomore; Hill; Coatsworth.

Chemistry 3.
2nd Yr. Med.

Class I. Morrish.

Class II. N. F. W. Graham.

Class III. J. R. Hammond; Locke; Tiffin; Empay and McNally, equal; Cheeseman; Hewson and Walton, equal; W. E. Ferguson and Leonard, equal.

French A.

Class III. Bowles; Hanson.

French 41.

Class II. Occomore; Backus.
Class III. Minish.

German 41.

Class II. Hanson.
Aeg. L. E. Miller.

Latin B.

Class III. Townsend; Hager.

Physiology

Class II. Valens; Morrish.
Class III. Leonard; Tiffin; Walton; Hammond; N. F. W. Graham; Cheeseman and Empay, equal; Locke; Ferguson; Hewson; McNally.

Physiological Chemistry.

Class II. Morrish; Leonard; Locke and Valens, equal; Cheeseman.
Class III. Empay and Hammond, equal; Tiffin and Walton, equal; McNally; N. F. W. Graham and Hewson, equal; W. E. Ferguson.

Physics 1 (a)

Class I. Townsend.
Class II. Hanson; Backus; Minish.
Class III. Bowles; L. E. Miller; Hill and Novak and Riopel, equal.

Physics 1 (b)
(Laboratory)

Class I. Townsend and Backus, equal; Hanson; Minish.
Class II. L. E. Miller; Bowles; Hill; Occomore.
Class III. German; Palmer.

Zoology 1.

Class II. Backus; Minish; Hill; L. E. Miller.
Class III. Bowles and Hanson, equal; Occomore; Townsend and Riopel, equal.

PHARMACY

Botany 1.

Class II. Fleming; I. E. Corbett; English and Switzer, equal.
Class III. Higginbotham; Bassett; Crosby.

Chemistry 3.

Class I. I. E. Corbett.
Class II. Fleming; English.
Class III. Bassett and Switzer, equal; Higginbotham.

Materia Medica.

Class II. Higinbotham; Fleming; I. E. Corbett; English.
Class III. Bassett; Switzer; Crosby and Dafoe, equal.

Pharmacy.

Class II. I. E. Corbett; Higginbotham; Fleming; Bassett; English.
Class III. Switzer; Dafoe; Crosby.

Pharmacology.

Class II. I. E. Corbett.
Class III. Higginbotham; Flemming; Switzer; Bassett; Dafoe; English; Crosby.

Toxicology.

Class III. I. E. Corbett; Fleming; Switzer; Higginbotham; Bassett and English, equal; Crosby and Dafoe, equal.

FACULTY OF APPLIED SCIENCE

Accountancy 51.
(Municipal Accounting)

Class II. Brown.
Class III. Buck; McInnes; J. A. Carswell; Jaffary; J. N. McDonald.

Architecture 1

Class I. McNeill.
Class II. A. E. Robinson.

Architecture 2 (Architectural Drawing)

Class II. Chubb; F. H. Taylor; R. McQueen.
Class III. Middleton; Moyle.

Architecture 3 (Architectural Design)

Class II. F. H. Taylor.
Class III. R. McQueen; Chubb; Moyle and Middleton, equal.

Architecture 4 (History of Architecture)

Class II. R. McQueen; F. H. Taylor.
Class III. Moyle and Middleton, equal; Chubb.

Architecture 5 (Building Construction)

Class II. F. H. Taylor and Middleton, equal; Chubb and R. McQueen, equal.
Class III. Moyle.

Architecture 6 (Decorative Arts)

Class II. F. H. Taylor; Chubb.
Class III. Middleton; R. McQueen; Moyle.

Architecture 58 (Specifications and Contracts)

Class II. F. H. Taylor.

Architecture 59 (Hygiene and Sanitation)

Class III. F. H. Taylor.

Bacteriology.

Class II. Berkov; Flint; Hallman; Martin.

Chemistry 1.

Class I. N. A. Clark and Cook, equal.
Class II. Galbraith; L. V. Miller; Slaughter; McKittrick; Annes.
Class III. J. E. Duncan; Westberg; McLellan; Larson.

Chemistry 51.

Class III. Hollies; Kidd.

Civil Engineering 1 (Applied Statics)

Class I. Cook.
Class II. Larson; McKittrick; N. A. Clark and L. V. Miller, equal; Slaughter; Galbraith.
Class III. Westberg; McLellan.

Civil Engineering 3 (Materials of Construction)

Class I. Cook.
Class II. Westberg; N. A. Clark; Galbraith; McKittrick; L. V. Miller; Slaughter; Lewis.
Class III. Larson; McLellan.

Civil Engineering 4 (Mechanics of Machines)

Class I. Cook.
Class II. Batson; L. V. Miller and Westberg, equal; McLellan.
Class III. McKittrick; J. E. Duncan.

Civil Engineering 5 (Surveying)

Class II. Cook; Westberg; N. A. Clark; Galbraith and McKittrick, equal.
Class III. Slaughter and Williamson, equal; L. V. Miller; Skarin and McLellan, equal.

Civil Engineering 52 (Foundations and Masonry)

Class I. L. S. MacDonald; W. S. McDonald.
Class II. Flint; Berkov.
Class III. Martin; Hallman.

Civil Engineering 53 (Geodesy)

Class I. Buck.
Class II. Brown; McInnes; J. A. Carswell.
Class III. J. N. McDonald.

Civil Engineering 55 (Hydraulics)

Class I. Batson.
Class II. Brown; Buck; J. A. Carswell; Hollies.
Class III. Kidd; J. N. McDonald; McInnes.

Civil Engineering 55 Lab. (Hydraulics)

Class I. Brown; Buck.
Class II. McInnes; J. A. Carswell; J. N. McDonald; Jaffary.

Civil Engineering 57 (Mechanical Engineering)

Class I. L. S. MacDonald; W. S. McDonald.
Class II. Berkov; Flint.
Class III. Batson; Hallman; Bell.

Civil Engineering 59 (Municipal Engineering)

Class I. L. S. MacDonald and W. S. McDonald, equal; Flint.
Class II. Berkov; Hallman.
Class III. Martin.

Civil Engineering 61 (Railway Engineering)

Class I. L. S. MacDonald.
Class II. W. S. McDonald; Flint; Berkov; Bell.
Class III. Hallman; Martin.

Civil Engineering 62 (Structural Design)

Class II. J. A. Carswell; Brown; Buck.
Class III. Jaffary and McInnes, equal; J. N. McDonald.

Civil Engineering 63b (Structural Design)

Class I. W. S. McDonald.

Civil Engineering 66 (Testing Laboratory)

Class I. L. S. MacDonald; W. S. McDonald.
Class II. Berkov; Flint; Hallman.
Class III. Martin.

Civil Engineering 67 (Theory of Structures)

Class II. Brown.
Class III. J. N. McDonald and Buck, equal; Bell.

Civil Engineering 68 (Water Power Engineering)

Class I. Brown; Hallman; Buck; Flint.
Class II. Berkov; J. N. McDonald; Bell.

Drawing 2 (Mechanical Drawing)

Class I. Atkinson.
Class II. W. J. Taylor; Lillico; Trelle.
Class III. Leach; Wong.

Drawing 3 (Freehand and Lettering)

Class I. McNeill.
Class II. Atkinson; W. J. Taylor; Lillico and Trelle, equal; Leach and A. E. Robinson, equal.
Class III. Miss Hill; Wong.

Drawing 4 (Descriptive Geometry)

Class I. McNeill; Atkinson; Butchart.
Class II. W. J. Taylor; McElwee; Trelle; Skarin.
Class III. Lillico; Miss Hill; Palsen; Wong; W. McDonald.

Drawing 5 (Machine Drawing)

Class II. Cook.

Electrical Engineering 53.

Class I. L. S. MacDonald.
Class II. W. S. McDonald; Berkov; Flint; Batson.
Class III. Hallman.

English 1.

Class II. W. J. Taylor.
Class III. Lillico; McNeill; Trelle.

French A.

Class II. Lillico.
Class III. James.

French 41.

Class II. McNeill; Miss Hill; A. E. Robinson; Drew.

French 42.

Class II. Moyle; McQueen.

Geology 52.

Class I. Brown.
Class II. Hollies; McInnes.
Class III. Buck; Reilly; J. A. Carswell; J. N. McDonald; Jaffary; W. McDonald.

Geology 53 (Petrology)

Class II. Annes.

Geology 54 (Canadian Geology)

Class II. Hollies; Kidd; Reilly; Annes.

Geology 54 (Mineralogy)

As above.

Geology 54 (Mineralogy)

Class II. Kidd; L. S. MacDonald; Hollies.
Class III. Reilly.

Mathematics 1 (b) and (c)
(Algebra and Trigonometry)

Class I. Lillico.
Class II. McNeill; Wong; Palsen; Moyle.
Class III. James.

Mathematics 3.

Class I. Atkinson; W. J. Taylor; R. McQueen.
Class II. Crawford; Williamson; Butchart; Trelle.
Class III. Palsen; Skarin; W. McDonald.
Aeg. Middleton.

Mathematics 5

Class I. Atkinson.
Class II. Trelle; McQueen; W. J. Taylor.

Class III. Butchart; Crawford; W. McDonald.
Aeg. Middleton.

Mathematics 6

Class I. Atkinson; Butchart.
Class II. W. J. Taylor; Lillico; Trelle; Williamson.
Class III. Skarin; W. McDonald and Palsen, equal.

Mathematics 9.

Class I. Cook.
Class II. N. A. Clarke; Slaughter; Larson.
Class III. McKittrick; Galbraith and Westberg, equal; Lewis.

Mathematics 11.

Class I. Cook; N. A. Clark.
Class II. Slaughter.
Class III. L. V. Miller; Larson; McKittrick; McLellan and Westberg, equal; Galbraith.

Mining Engineering 51 (Mine Mapping and Surveying)

Class I. Hollies; Reilly.

Mining Engineering 52 (Ore Dressing)

Class II. Kidd; Hollies.
Class III. Lewis; Reilly; Annes.

Mining Engineering 54 (Fire Assaying Lab.)

Class I. Kidd; Hollies; Annes; Lewis; Reilly.

Mining Engineering 55 (Metallurgy)

Class I. Hollies.
Class II. Kidd; Reilly; Lewis.

Mining Engineering 56 (Mining Engineering)

Class II. Annes; Kidd; Hollies.
Class III. Lewis; Reilly.

Physics 3.

Class I. Atkinson.

Class II. W. J. Taylor; Butchart; McNeill.
Class III. Lillico; Trelle; Williamson; Miss Hill; Skarin and Wong, equal.

Physics 3 Laboratory.

Class I. Atkinson.
Class II. McNeill; Taylor; Lillico; James; W. A. McKay; Skarin; Leach; A. E. F. Robinson and W. McDonald, equal.
Class III. Butchart; Wong; Miss Hill and Trelle, equal.

Physics 4.

Class I. N. A. Clark.
Class II. Larson; Slaughter; Cook.
Class III. Galbraith and L. V. Miller, equal; Westberg.

Physics 4 Laboratory.

Class I. Cook.
Class II. N. A. Clark; Westberg; Slaughter; Larson; L. V. Miller.
Class III. Galbraith; J. E. Duncan and McKittrick, equal; McLellan.

SCHOLARSHIPS

Faculty of Arts and Sciences

First Year:—Miriam Lois Bowman
Second Year:—George Samuel Montgomery

Faculty of Applied Science

First Year:—Nelles Henry Atkinson
Second Year:—Alexander Joseph Cook

Alberta Women's Association Scholarship

For Women in the first year of Arts and Sciences:
Miriam Lois Bowman
Awarded by reversion to Doris Catherine Smith

PRIZES

The English Bible Prizes:—

First ($75.00):—Douglas Hastings Telfer
Second ($50.00):—Harold Russell Leaver
Third ($25.00):—Stanley Scott.

The Jane Alexander Memorial Prizes:—

In Latin:—George Samuel Montgomery.
In Geology:—Reuben B. Sandin.

The Blais Prizes in French Composition:—

Senior Courses ($15.00):—George Henry Holmes
Junior Courses ($10.00):—Meta Florence Cross

MEDALS

The Governor-General's Silver Medals:—

In Arts and Sciences:—George Samuel Montgomery
In Applied Science:—Alexander Joseph Cook

The Charles Allan Stuart Gold Medal in Classics:—
George Henry Holmes

The Alexander Cameron Rutherford Gold Medal in English:—
Samuel Richard Hosford

The Alberta Women's Association Gold Medal in General Proficiency:—William Robinson Howson

The John A. McDougall Gold Medal in Applied Science:—

(1) Leslie Stewart MacDonald

(2) **Medal Prize:**—William Sutherland McDonald

The Grace Ferris Gold Medal in Modern Languages:—

Not awarded.

FELLOWSHIP

The Lloyd Hartnoll Bishop Memorial Fellowship in English Literature:—

Harold Russell Leaver

DEGREES

Passed with Honors for the degree of Bachelor of Arts:—

Holmes, George Henry (*First Rank Honors in Classics*).
Hosford, Samuel Richard (*First Rank Honors in English*).
Leaver, Harold Russell (*First Rank Honors in Philosophy*).
Seyer, William Frederick (*First Rank Honors in Chemistry*).
Clark, Harry Cleminson (*Second Rank Honors in French*).
Edgar, John (*Second Rank Honors in Latin*).

Passed for the degree of Bachelor of Arts:—

Barclay, Helena Katharine Margaret.
Bird, Harry Smith.
Bremner, Charles Carlyle.
Boness, Olaf Conrad.
Bosomworth, Hubert.
Carswell, Charles Frederic.
Dymond, Samuel James.
Ferguson, Samuel Cranswick.
Fulmer, Edith Adams.
Graham, Nelson Franklin Wesley.
Hammond, John Ralph.
Hipkin, George Alfred.

Howson, William Robinson.
Jackson, Joseph Leonard.
Jackson, Roy Chavatte.
MacDonald, Neil Douglas.
Menzies, Margaret Ethel.
Murphy, Thomas.
Sheane, George Kennedy.
Smith, Marion Mabel.
Smith, Walton Larue.
Stevens, George Roy.
Taylor, Howard Thomas.
Tuttle, Gwynethe Marie.
Wilson, Harry Jackson.
Wilson, Thomas James.
Young, Frederick George.

Granted the degree of Bachelor of Arts, ad eundem:—

Barrett, Anthony Patrick (Michigan).
Gill, Marian (London).
Horricks, Henry Magee (McMaster).
Hyde, Ernest Elmer (McMaster).
Newland, Hubert Charles (Toronto).
Stenhouse, Jessie Isabel (McMaster).
Williams, Reginald Firmston (London).

Passed with honors for the degree of Bachelor of Science in Arts:—

Robinson, George (*First Rank Hon. in Mathematics*)

Passed for the degree of Bachelor of Science in Applied Science:—

MacDonald, Leslie Stewart (*With First Class Standing*).
McDonald, William (*With First Class Standing*).
Berkov, Abraham.
Flint, Chauncey Dalrene.
Hallman, Abner.

Passed for the degree of Bachelor of Laws:—

Archer, Joseph.
Brokovski, John Craig.
Crawford, John White.
Forster, Howard E.
Fraser, George Everard.
Popple, Arthur Ernest.
Porte, George Reginald.

Granted the degree of Bachelor of Laws, ad eundem:—

Hugill, J. W. (King's College).

Admitted to the degree of Master of Arts:—

Adam, James.
Ottewell, Albert Edward.
Quance, Francis Melville.
Sheppard, Ross Stanley.
Telfer, Douglas Hastings.

Granted the degree of Master of Arts, ad eundem:—

McKnight, Locksley (New Brunswick).

Granted the degree of Doctor of Medicine, ad eundem:—

Ritchie, Arthur Bullard (Toronto)

Admitted to the degree of Doctor of Science (Honoris Causa):

Ferrier, Walter Frederick.

RESULTS OF EXAMINATIONS CONDUCTED FOR AFFILIATED SOCIETIES

LIST OF SUCCESSFUL CANDIDATES

Architecture, September, 1914.

Jeffers, A. M.

Dentistry, September, 1914.

Alcombrack, A. W.
Clarke, H. J.
Earlywine, V. A.
Fletcher, C. M.
Geering, W. H.
Norby, W. A.
Sargent, R.

Medicine, September, 1914.

Cross, W. W.
Galbraith, C. T.
Gray, F. R.
Moore, T. W.
Phillips, J. H.
Swartzlander, H. C.
Thomson, J.

Osteopathy, September, 1914.

Hastings, J. H. E.

Alberta Land Surveyors, January, 1915.

Johnston, R. H.
McMillan, George.
MacLeod, D.D.
Robinson, W. E.
Wrong, F. H.

RESULTS OF LL.B. EXAMINATIONS,

September, 1914.

Canadian Constitutional History

Class I. Lawlor.
Class II. Archer and Boyd, equal.
Class III. Kelly and Russell, equal; Barron.

English Constitutional History.

Class II. Lawlor; Barron; Russell.
Class III. Boyd and Kelly, equal.

Constitutional Law.

Class I. Russell.
Class II. Valiquette; Miss Clements.
Class III. McGuire; Barron; Low; Casselman and Pollard, equal; Kelly and White, equal.

Company Law.

Class II. Soltau.
Class III. Barron.

International Law.

Class I. Valiquette.
Class II. Casselman and Gordon, equal; Barron and Russell, equal; White.

History of English Law.

Class III. Barron; Miss Clements.

History of Roman Law.

Class I. Popple and Russell, equal.
Class II. White; Barron.

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THE

UNIVERSITY OF ALBERTA

EDMONTON

Examination Papers 1914-1915

Final Examinations

December

Session of 1914-15

UNIVERSITY OF ALBERTA.

FACULTY OF MEDICINE
FACULTY OF APPLIED SCIENCE

BOTANY 2

Saturday, December 19th, 1914. **Morning, 9.00 to 12.00.**

1. Describe in general terms the gametophytes of a moss and of a fern. Describe in detail the position and nature of the female gametophyte of a member of the Coniferae such as Pinus.

2. What is transpiration? How would you demonstrate its occurrence in a living plant? Of what use is the process of transpiration to the plant?

3. Describe the salient features to be seen in the several stages of cell division. What is the significance of, and where does the reduction in the number of chromosomes occur?

4. Describe with the aid of sketches the life history of a typical member of the Phycomycetes such as Mucor.

5. Compare and contrast the method of sexual reproduction in Mucor, Œdogonium, Polytrichum and Pinus.

UNIVERSITY OF ALBERTA.

FACULTY OF MEDICINE
FACULTY OF PHARMACY

CHEMISTRY 2.

Thursday, December 17th, 1914. Afternoon, 1.00 to 4.00.

Candidates are requested to answer any seven of the following questions and to give equations wherever possible.

1. Describe and explain fully the experiment known as the hydrogen fountain illustrating the diffusion of gases.

2. Describe three distinct methods for preparing oxygen.

3. (a) Illustrate the fact that chlorine combines more readily with hydrogen than with carbon.

   (b) Explain the use of manganese dioxide in the preparation of chlorine gas.

4. Describe fully what takes place in any *three* of the following cases:
   (a) When hot concentrated sulphuric acid is brought into contact with copper.
   (b) When a solution of chlorine in water is exposed to direct sunlight.
   (c) When an electric current passes through a solution of sodium sulphate in water.
   (d) When bromine acts on red phosphorus moistened with water.

5. State how a fatal case of arsenic poisoning may be detected, giving the precautions which have to be observed.

6. Describe two methods for the preparation of sulphuric acid.

7. State what takes place when the following substances are

heated: (a) mercuric oxide; (b) lead nitrate: (c) potassium chlorate; (d) ammonium nitrite; (e) basic sulphate of iron; (f) potassium nitrate.

8. (a) Compare from a chemical standpoint the use of hydrogen peroxide and hypochlorous acid as antiseptics.
(b) Give the test for hydrogen peroxide.
(c) State how hydrogen peroxide may be prepared.

UNIVERSITY OF ALBERTA

FACULTY OF APPLIED SCIENCE.

ADVANCED STRUCTURES.

(C. E. 51).

Thursday, December 17th, 1914. Morning, 9.00 to 12.00

1. Find the stresses in each of the members of the three hinged arch with U_2U_3 removed.

2. Find the horizontal and vertical reactions with the member U_2U_3 in the structure.

3. Describe the Reaction Intersection Locus and the Reaction Tangent Curves for a hingeless arch and show how they are used to obtain the critical loading for the maximum fiber stress at a given section.

4. State two of the most common sets of assumptions for high steel frame buildings. Apply either set to finding the maximum moment, shear and direct stress of the members of the structure shown in Fig. 2.

FACULTY OF APPLIED SCIENCE.

FRAMED STRUCTURES.

(C. E. 53).

Monday, December 14th, 1914. Afternoon, 2.00 to 5.00.

Figures accompany questions 1, 2, 3, 4, 5, 6.

1. Find the maximum stress, due to an E-40 loading, in the members a, b, and c of the truss shown.

2. Draw influence lines for a, b, c, d, e and f, and find the maximum stress, or its component, for a load of 2,000 lbs. per foot and a locomotive excess of 20,000 pounds.

3. Write the index stresses for the truss shown.

4 & 5. Draw influence lines for a, b and c in the trusses shown for each question.

6. Find the stresses in bars a, b and c.

UNIVERSITY OF ALBERTA.

FACULTY OF APPLIED SCIENCE.

HYDRAULIC MACHINERY.

(C. E. 56)

Thursday, December 17th, 1914. Morning, 9.00 to 12.00

1. Derive the fundamental equation for the actual lift in a centrifugal pump including the gain in volute and all losses.

2. In a centrifugal pump the diameters of the suction and discharge pipes=48 inches, the number of wheel blades=6; the blade thickness=$\frac{7}{8}$ ins.; the radial velocity of flow at outlet=2.88 ft per sec.; the velocity of flow in the volute and discharge pipe=5.82 ft. per sec.; the peripheral speed of the wheel outlet-surface=34.64 ft. per sec. Disregarding the frictional losses in the suction and discharge pipes and in the wheel passages, determine the velocity of whirl at outlet, the blade tip angles at outlet, the delivery in cubic feet per sec., the speed in revolutions per minute, the actual lift and the depth of the weel at outlet, the efficiency being 0.76 and the outside diameter of the wheel being $8\frac{1}{4}$ feet.

3. A centrifugal pump delivers 15 cubic feet per sec to a height of 28 ft.; the radial velocity at inlet=$\frac{1}{4}\sqrt{2g \text{ Lift}}$; the suction and discharge pipes are 42 ft. long and the hydraulic losses in the pump itself are equivalent to a loss of head in a length of pipe=80 diameters (delivery diameters).

   Find the dimensions of the wheel, the gross lift and the efficiencies.

   Take the radial velocity at outlet=radial velocity at inlet.

4. A hydraulic crane working at 750 lbs. per square inch, with

efficiency of 70% has to lift 4000 lbs. through 50 ft. at a rate of 200 f.p.m. once every $1\frac{3}{4}$ minutes.

If an accumulator is provided, find the volume of the crane cylinder, the minimum H.P. of the pump and the minimum capacity of the accumulator.

5. Sketch and describe some type of hydraulic rivetter.

FACULTY OF APPLIED SCIENCE.

PRACTICAL ASTRONOMY.

(C. E. 60).

Thursday, December 15th, 1914. Afternoon, 2.00 to 5.00

1. Define:—meridian, vertical circle, equator, horizon, prime vertical, latitude, longitude, vernal equinox, declination, right ascension.

2. Explain two methods of locating a point on the celestial sphere.

3. (a) Describe the various systems of time, indicating clearly the differences between them.

   (b) Find the standard time, at long. 112°35′ 24″W., of the culmination of a star whose R.A. is 22hr. 42m. Dec. 16th.

4. (a) Describe fully the zenith telescope.

   (b) Show how to use it to find latitude, explaining the theory.

5. (a) Describe an observation to find the astronomical meridian at any point.

   (b) Find the Az. of the mark at long. 112°35′ 24″W., given the following obs. on Dec. 23rd 191 .

Hor. Circle		Vert. Circle	M.S.T.
Mark	Sun		
0° 00′	168° 59′		2hr. 52m. 45s.
	169° 52′		2hr. 55m. 37s.

δ at G.M.N.=—18° 42′ 43″.6 cor. +35″.94 per hr.
Lat.=53° 32′ Eq. of T. at G.M.N. to be added to mean time=—3m 50″.96 cor. —.001″ per hr.

6. A star (R.A. 19hr. 46m 29s; $\delta = 8^\circ\ 38'$N.) is observed to have a corrected altitude of $26^\circ\ 30'$ and an Az. 75° W. of S. What is the lat. and the Sidereal time of the observation?

7. The sun is observed in Long. 5 hr. 30m. W and Lat. $53^\circ\ 32'$N. at equal altitudes at 10 hrs. 15m E.S.T. A.M. and 2 hr. 25m P.M. E.S.T. on March 29th. What is the bearing of true North if the bearings of the A.M. and P.M. observation were $150^\circ\ 24'$ and $208^\circ\ 42'$ respectively?

UNIVERSITY OF ALBERTA.

FACULTY OF APPLIED SCIENCE.

STRUCTURAL DESIGN.

(C. E. 63).

Wednesday, December 16th, 1914. Afternoon, 2.00 to 5.00.

1. Discuss fully the development of the wooden and steel truss bridges in both Europe and America.

2. Draw outline sketches of a stone voussoir arch with spandral walls, a wooden Howe truss, a steel Whipple truss, a cantilever bridge, and a suspension bridge. Name the different parts of each.

3. Give the history of Cast Iron as a bridge material. What are the advantages and disadvantages pertaining to its use?

4. A Pratt truss has two panels of 20 feet and a depth of 20 feet. The total stresses in certain members are as follows;
   U_0L_0 110,000 pounds compression,
   U_0L_1 123,000 pounds tension,
   Design these two members.

UNIVERSITY OF ALBERTA.

FACULTY OF APPLIED SCIENCE.

TESTING LABORATORY.

(C. E. 65).

Friday, December 18th, 1914. Afternoon, 2.00 to 5.00.

1. Show how to obtain experimentally the value of G, the shearing modulus of elasticity, by means of a spiral spring.

2. Sketch and describe the Riehlé testing machine in the laboratory and show clearly how it may be used to carry out tension, compression and transverse tests

3. State the standard tests which should be applied to Portland cement and describe three of the tests in detail, stating the significance of each.

4. Show how to obtain the efficiency of screw gearing.

   Given the following data calculate the efficiency of the lift.

Weight lifted. =W	Force to lift W.
350 lbs.	14.5 lbs.
550 "	23. "
827 "	35. "
970 "	43 "

Chain pulled off to lift W 1.02 feet=32.52 ft.

5. Deduce the expression for the friction coefficient "μ" of a belt in terms of the tensions on the ends and the angle of embrace.

   Calculate the average value of "μ" from the following data.

   Angle of embrace=180°.

T_2=in lbs.	2	4	6	8	10.
T_1 " "	5.5	10.6	15.5	21.4	27.2.

FACULTY OF APPLIED SCIENCE

THEORY OF STRUCTURES

(C. E. 67)

Wednesday, April 14th. Morning, 9.00 to 12.00.

1. Define: Unit stress; allowable unit stress; modulus of elasticity; factor of safety. The cylinder head of a steam engine is bolted to the cylinder 12″ diam. with 8 bolts 1 inch diam. The maximum pressure in the cylinder is 200 lb./B.″ What is the intensity stress in the bolts due to this pressure?
2. Write out the assumptions for the beam theory. Let the beam be cut by any cross section and with the equations of equilibrium for either portion. Then derive the formula for the fibre stress at any point.
3. A beam is made up of two pieces as shown. Assume that each bolt will carry 2000 lbs. How many bolts are required between the load of 6000 and the end?
4. Write down the general forms of Euler's formula, the Gordon Rankine formula and the Straight Line formula, for pin ended columns. Explain what they mean and how they are used in the design of columns. A column 20′ long carries a load of 100,000 lbs. and is made up as follows:

   2-8″ 3/8″ pls.
   2-6″-8 lb. Channels.

   Find the intensity stress on any cross section. What is the allowable unit stress using straight line formula for steel?
5. Derive the formula for the deflection at any point of a simple beam uniformly loaded.
6. Find the proper diameter of a shaft to transmit 40 H. P. at 500 R. R. M. f 8000 lbs. per sq. inch strength.
7. Find the maximum stress, neglecting weight of metal.

FACULTY OF APPLIED SCIENCE

GEOMETRICAL DRAWING

(Drawing I)

Wednesday, December 16th, 1914. Afternoon, 1.00 to 4.00

1. A square, a hexagon, and a heptagon have a common side AB 1·5 inches long. Draw these figures. In the hexagon place three equal circles, each touching two sides of the hexagon and two other circles.

2. A line CD is three inches long. With C and D as centres circles are described having a radius of 1 inch and ·7 inches respectively. Describe a circle, radius 1.5 inches to touch the given circles.

3. Construct a triangle having sides in the proportion of 3: 4: 5, making its area 4 square inches.

4. Construct a triangle of which the vertical angle is 43°, the base angle 60° and the semi-perimeter 5 inches. Divide the triangle into three equal areas by lines parallel to the base. Describe a circle equal in area to one division of the triangle.

5. An irregular polygon ABCDE has the side AB 2 inches, BC 2·3 inches, DE 2·5 inches, angle ABC 135°, angle ACD 70°, angle DAE 35° and the diagonal AD 4 inches. Construct this figure and reduce it to a triangle of equal area. Find the side of a square which will be equal in area to the triangle.

6. In a circle of 2 inches radius inscribe a triangle similar to the triangle of Prob. 5. In the triangle inscribe a square.

7. In a circle of 2 inches radius inscribe a regular heptagon. Within this heptagon place a similar figure with sides 1 inch long, and equidistant from the sides of the outer heptagon.

8. Two concentric circles, radii 3 inches and 2·3 inches respectively, are drawn. By means of these construct an

ellipse. From any point E on the ellipse draw a tangent and normal.

9. An arc BC of a circle of 2 inches radius subtends an angle of 135° at the centre. Shew the sector of the circle thus formed. A circle of .5 inch radius rolls along AB, BC outside of the sector. Shew the path of that point on the circumference of the circle which is at first in contact with A.

FACULTY OF ARTS AND SCIENCES.

GEOMETRY.

Math. 1(a).

Saturday, December 19th, 1914. Morning, 9.00 to 12.00

1. (a) To construct a regular pentagon in a circle.

   (b) If three straight lines be proportionals, as the first is to the third, so is any rectilineal figure described on the first to a similar and similarly described rectilineal figure on the second.

2. (a) Find and prove correct the locus of the vertices of all triangles on a given base and having a given vertical angle.

   (b) Construct a triangle, having given the base, the vertical angle, and the point at which the base is cut by the bisector of the vertical angle.

3. In a right triangle the length of the hypothenuse is 10 inches and the lengths of the legs are x inches and y inches. The corresponding sides of another right triangle are of length 13 inches, X inches and Y inches, respectively. If $x:X=10:13$, prove $x:X=y:Y$; show that the triangles are similar; and find the numerical value of the ratio of their areas.

4. Find the equation of the locus of the points equally distant from the points (2,1) and (-4,3).

5. The coordinates of the vertices A, B and C of a triangle are (-3,2), (3,-2) and (0,-1). D and E are the middle points of BC and CA. Prove analytically that DE is parallel to AB and equal to one-half of it. Find the equations of the side AB and of the straight line through C parallel to AB.

6. (a) Find the equation of the circle whose center is (-5,-2) and which passes through the point (7,7).

(b) Does the circle pass through the points (2,9) and (-10,10)?

7. Find, graphically and algebraically, the intersections of the loci of the following pairs of equations:

   (a) $x^2+y^2=25$; $3x+4y=25$.

   (b) $2x+y=1$; $y^2+4x=17$.

   (c) $x^2+y^2=17$; $xy=4$.

   (d) $x^2-y^2=25$, $y=10$.

8. In an experiment illustrating Hooke's Law, the following are found to be corresponding values of the length of the spring, L inches, and the weight suspended from it, W lbs. Find a straight line law to fit the data.

W	0	5	10	15	20	25
L	8	8¾	9½	10	10¾	11½

Faculty of Applied Science

GEOMETRY

(Math. 4).

Friday, December 18th, 1914. Afternoon, 2.00 to 5.00

1. If two intersecting lines in one plane are parallel, respectively, to two intersecting lines in another plane, then the two planes are parallel, and the corresponding angles formed by the lines are equal.

2. Find the volume and total area of a regular octahedron whose side is 8. Find also the volume of the sphere circumscribed about it.

3. Find the locus of points equally distant from three givne points.

4. Water is poured into a conical vessel whose vertex points downwards. How many gallons will the vessel contain when the water is 10 inches deep, if it contains $\frac{1}{2}$ gallon when the water is 6 inches deep? Draw a graph showing the relation between the depth and the number of gallons of water.

5. Prove that the area of a spherical triangle in terms of spherical degrees is equal to its spherical excess.

6. What portion of the earth's surface lies between the parallels 30° North and 30° South?

7. A cylindrical tank 8 feet in diameter, partly filled with water, is lying on its side. (a) If the greatest depth of the water is 6 feet, what fraction of the tank is filled with water? (b) If the width of the upper surface of the water is 4 feet, how deep is the water, and what fraction of the tank is filled with water?

8. The frustum of a right circular cone has bases whose areas are 10π and 40π, and its altitude is 7. Find the volume of the frustum, and also of the whole cone. Show whether

or not the slant height and area of the frustum can be computed from the numbers already given.

9. Given a solid sphere of radius 12 inches. A cylindrical hole is bored through it so that the axis of the cylinder passes through the center of the sphere. If the diameter of the cylinder is 4 inches, find the area and volume removed from the sphere by the process.

10. The lateral area of a right circular cylinder is A, and the volume is V. Find formulae for the altitude and the radius of the base.

FACULTY OF ARTS AND SCIENCE

GEOMETRY
(Math. 7)

Friday, December 18th. 1914. Afternoon, 2.00 to 5.00.

1. Find the locus of all points which are at a given distance d from a given plane, and also at a distance d' from a given line.

2. Find the volume of a regular octagonal prism inscribed in a right circular cylinder whose altitude is 8 feet, and diameter 4 feet.

3. At what angle to the horizontal must the base of a right circular cylinder be tilted to make it just topple over if its diameter is 8 ft. and altitude 10 ft.?

4. Find the lateral area of a frustum of a right circular cone if its altitude is 4 ft. and the radii of its bases 6 and 8 ft.

5. Find the volume of the frustum in 4.

6. Why are there only five regular palyhedrons?

7. Find the volume of a regular octahedron.

8. Prove that the area of a sphere is $4\pi r^2$.

9. What is the volume of that part of the earth north of 60° north latitude?

10. Find the radius of the sphere whose area is numerically equal to the volume of the regular tetrahedron circumscribing it.

FACULTY OF APPLIED SCIENCE.

ANALYTIC GEOMETRY
(Math. 10).

Saturday, December 19th, 1914. Morning, 9.00 to 12.00.

1. Given the points A (2,2), B (4,4), and C (—8,4);
find (a) the area of the triangle ABC,
(b) the angles A, B and C,
(c) the centre of the inscribed circle,
(d) the centre of the circumscribed circle,
(e) the area of the triangle formed by drawing lines through A, B and C parallel to the opposite sides.

2. Find the equation of the circle
(a) passing through the points (3,5) and (—3,7) with its centre on the line $2x-3y-6=0$;
(b) passing through the points (—3,1) and (1,1) and tangent to the line $4x+3y+25=0$.

3. Sketch the loci of the following plane curves:

(a)	$9x^2+16y^2=64$	(e)	$y=\sin x+\log x$
(b)	$9x^2-16y^2=64$	(f)	$y^2=x\frac{a+x}{a-x}$
(c)	$9x^2-16y^2=0$	(g)	$\rho=10\cos\theta$
(d)	$9x^2+16y^2=0$	(h)	$\rho^2=a^2\cos 2\theta$

4. Simplify the following equations and construct the loci:
(a) $x^2+3xy+y^2+4y=0$
(b) $x^2+4y^2-16x+24y+84=0$.

5. Find the parametric equation of a cycloid.

Faculty of Applied Science

MECHANICS

(Math. 54)

Wednesday, December 16th, 1914. Morning, 9.00 to 12.00

1. A chain is wrapped twice around an iron drum, and a pull of 100 pounds just supports a weight of 50 tons; find the coefficient of friction.

2. The weight of a pile-driver is 10 tons. It falls through a height of 20 ft. on a pile weighing 2 tons, driving it 2 inches into the earth. Find the resistance of the earth.

3. Weights of 5 and 12 lbs. have initial velocities in the same direction and along the same line of 40 ft. and 30 ft. per sec. If the coefficient of restitution between them is .8, find their velocities after impact, and the loss of K.E.

4. Find the magnitude of a force acting at an angle ω with a plane of inclination x which will just start a body weighing W lbs. up the plane, given that θ equals the angle of friction. For what value of ω is the force a maximum or a minimum?

5. A fly-wheel weighing 10 tons (weight at the rim) and of radius 10 ft. revolving at the rate of 60 r.p.m. is brought to rest in 10 seconds by a brake acting on the rim. Find the h.p. wasted in stopping the wheel. If the pressure on the brake is one ton find the coefficient of friction.

6. A sphere of radius 5 feet and weighing 100 lbs. is rolling along a horizontal plane with a linear velocity of 100 ft. per second; find its K.E.

7. At what angle should a circular automobile speedway one mile in circumference be banked for a speed of 60 miles per hr. in order to prevent any tendency to skid?

8. A ladder 20 ft. long and weighing 90 lbs. rests at an angle of 30° with the horizontal against a vertical wall. If the coefficient of friction is .6, how far can a man weighing 150 lbs. mount the ladder before it will slip?

FACULTY OF APPLIED SCIENCE

ASSAYING.

(M. E. 54.)

Wednesday, December 16th, 1914. Afternoon, 1.00 to 4.00

Answer any eight questions including No. 6.

1. (a) Define the term "Assaying". How does Fire-Assaying differ from other methods of Assaying? Name the different metals that may be determined by the Fire Assay.

   (b) Upon what *one* operation, more than any other, does the accuracy of any assay depend?

2. Make a sketch showing a combination Pot and Muffle Furnace and explain the different part each plays in the fire assay.

3. Write short notes on:—Fusion, Scorification, Cupellation. Parting.

4. Name the principal fluxes and reducing agents used in Fire Assaying.
   Given,—Pb=207, O=16, C=12, find the reducing power of carbon in terms of lead.

5. Discuss Assay Slags as to acidity, basicity and color. What colors are produced in the Scorifier by Cobalt, Copper, Lead, Nickel and Iron?

6. A sample of 300 gms of a Silver Gold ore contains 6 p.c. of metallics. The pulp runs 50 p.c. Silica, 18 p.c. Pyrite, 20 p.c. Ferric Oxide. Explain the method of assay and calculate the charge you would use.
   Given,—For a monosilicate, 1 gm. of silica requires Fe_2O_3—2.7 gms., $NaHCO_3$—5 gms., PbO—7 gms.
   Reducing power of Pyrite—12 gms.
   Reducing power of Flour—11 gms.
   Oxidizing power of Nitre—5 gms.

7. Explain the Iron Nail method *or* the "Excess litharge" method of assaying. For what kinds of ore is it suitable?

8. Discuss the losses of scorification, the effect of impurities and the losses in cupellation.

9. Discuss the Fire Assay of Lead *or* the Fire Assay of Tin.

FACULTY OF ARTS AND SCIENCES

SOLID ANALYTIC GEOMETRY

(Math. 103)

Saturday, December 19th, 1914. Morning, 9.00 to 12.00

1. Show that the three lines joining the middle points of opposite edges of a tetrahedron meet in a point. Show also that this point is on the line joining any vertex with the point of intersection of the medians of the opposite face, and divides that line in the ratio of 3:1.

2. Prove that any equation of the first degree represents a plane.

3. (a) Find the equations of the straight line whose direction cosines are l, m, n and which passes through the point (x_1, y_1, z_1).

   (b) Find the equations of the straight line joining the two points (x_1, y_1, z_1) and (x_2, y_2, z_2), using as parameter the ratio in which the segment formed by the two fixed points is divided.

4. The parabola $y=z^2$, $x=0$ is revolved about the Z-axis. Derive the equation of the surface generated.

   (b) Discuss and sketch the locus of the equation
   $$x^2+y^2+z^4=25.$$

5. Using the equations derived in 3 (a), show that every line meets a surface of the nth degree in n points.

6. Explain how the equation of the tangent plane to an algebraic surface may be found, illustrating the method by finding the equation of the tangent plane of the surface $x^2+y^2+z^4=25$ at the point $(1, 2\sqrt{2}, 2)$.

7. Determine the nature of the following quadrics:

   (a) $x^2+4xz+y^2+2z^2=0$

   (b) $x^2+2xy+y^2-4z^2+4z-1=0$

   (c) $11x^2+10y^2+6z^2-8yz+4zx-12xy-12=0$

   (d) $3z^2-6yz-6zx-7x-5y+6z+3=0$

8. Prove that in any ellipsoid

   (a) the sum of the squares of any three conjugate diameters is constant.

   (b) the volume of the parallelopiped which has three conjugate semi-diameters for coterminous edges is a constant.

9. Lines are drawn joining the points on the lines

   $x=a,\ y=bz$

   and $x=-a,\ y=-bz$

   which have the same z—coordinate. Show that the lines all lie on a hyperbolic paraboloid.

10. Show that the tangent lines drawn from a point to a quadric meet the quadric in a plane curve which is the intersection of the quadric and the polar of the point.

FACULTY OF APPLIED SCIENCE

PROPERTIES OF MATTER
(PHYSICS 2)

Thursday, December 17th, 1914. Afternoon, 1.00 to 4.00.

1. Outline the molecular theory of matter, and on a basis of this theory distinguish between solids, liquids and gases. Applying the theory to gases, what do you consider to be the meaning of (a) temperature, (b) pressure?

2. State the Law of Universal Gravitation. What will be the weight of (or Earth's attractive force on) a body of 100 lbs. mass, (a) at the centre of the Earth, (b) at the surface of the Earth, (c) at a distance of 2000 miles from the surface of the Earth?

3. Explain what is meant by *tensile stress* and *strain*, and by the *limit of elasticity*.

   A rod of steel, of circular cross-section 1 inch in diameter and 20 feet long, was stretched below the elastic limit with a load of 20,000 pounds. The extension was measured as 0.01 inches. Find the modulus of elasticity.

4. Give reasons for the phenomena of surface tension and capillarity. Show mathematically that, in the case of a liquid which *wets* a tube, the height of capillary rise is directly proportional to the surface tension of the liquid.

5. What is meant by *viscosity*? Devise experiments to show the action of viscosity (a) of a liquid, (b) of a gas.

6. Explain why a cylindrical spiral spring of brass wire may be used as a balance to find the weight of a body. Describe how the operation would be performed.

Final Examinations

April

Session of 1914-15

Faculty of Applied Science.

MUNICIPAL ACCOUNTING

(Acct. 51)

Tuesday, April 20th. Morning, 9.00 to 12.00

1. What is your idea of the function of Accounting? Wherein does Municipal Accounting resemble, and wherein differ from, the accounting of a business firm?

2. Clearly differentiate between
   (a) Trial Balance and Balance Sheet.
   (b) Bonded Debts and Contingent Liabilities.
   (c) Current Assets and Fixed Assets.
   (d) Operation and Maintenance.
   (e) Depreciation and Obsolescence.
   (f) Appropriation and Temporary Loans.

3. A municipality issues a statement called "Receipts and Expenditures." Discuss the title and the misleading results that may be presented thereunder.

4. Supplying figures, give and explain the use of
   (a) A Bank Reconciliation Statement.
   (a) A Fund Balance Sheet.
   (c) A Debenture Register.

5. State the principles underlying a good classification of expenditures.

6. A city having an assessed valuation of thirty millions, issues bonds to the amount of $200,000 for the erection of a school and arranges to pay principal, and interest at 6 per cent., in twenty equal annual instalments. Find the increase in the tax rate and the increase in the taxes of a citizen whose property is assessed at $40,000.

7. A debt of $200,000 is to be met at the end of 20 years by means of a sinking fund bearing 4 per cent. How much should be in the fund at the close of the tenth year?

8. Discuss the provisions of the Town Act of Alberta with respect to
   (a) the appointment of officials, commenting on their selection by tender.
   (b) returns made to the Government.
   (c) money by-laws.
   (d) bonus to industries.
   (e) expropriation.

Department of Architecture

HISTORY OF ARCHITECTURE
(Arch. 4)

Thursday, April 22nd. Afternoon, 2.00 to 5.00.

1. Illustrate points of difference between ancient Egyptian and ancient Assyrian architecture which arose through the influence upon architectural forms of the familiar local building materials.
2. Illustrate by sketch plan elevation and section and also by written description the characteristic arrangements of an ancient Egyptian temple.
3. Describe the Parthenon at Athens showing in what respect it differs from the typical hexastyle Doric temple; sketch the plan and cross section and details of the "order" employed.
4. Describe and illustrate by sketches the Roman thermae.
5. Describe with sketches the arrangements of the plan and of the vaulting of the Church of St. Sophia at Constantinople.
6. Describe and compare the methods and processes of surface decoration employed in ancient Grecian, Roman and Bysantine architecture.

DEPARTMENT OF ARCHITECTURE

BUILDING CONSTRUCTION

(Arch. 5.)

Friday, April 23rd. Afternoon, 2.00 to 5.00

1. Draw to the scale of half-inch to one foot the plan and elevation of an arcade in brick consisting of three semi-circular arches with piers three feet square between the archways, the end piers being 3'0" x 5'0", the openings to be 6'0" wide and 6'0" high to the springing; the arches to be turned in three four-inch rowlocks. Shew sufficient of the individual bricks on plan and elevation to indicate how every part of the work is to be bonded. Name the type of bond you select for the work. (22.)

2. Draw the elevation and plan to one-half inch scale of an arched doorway all in stone with one three-quarter column on each side supporting an entablature which passes over the top of the archway. Shew all the joints of the stonework. (22)

3. Draw to one-half inch scale the elevation of a queen-post roof truss over a 45'0" span; shew the common rafters; figure the sizes of all the members of the roof; give 1½" scale details of all joints; specify which members are in tension and which in compression. (22)

4. Illustrate various methods of joining boards together to form a flat surface upon one side in such a way as to prevent warping and splitting. (10)

5. Sketch the following:—the joint of the top rail with the style of a door; a tusk tenon; a dovetail corner; a mitred corner with a feather. (10)

6. Draw full size section through jamb, meeting styles and sill of a window with permanent sashes hung to open inwards and winter sashes hung to open outwards. (14)

NOTE.—*The figures in brackets are the marks alloted to each question.*

Department of Architecture

DECORATIVE ARTS: WOODWORK

(Arch. 6.)

Friday, April 23rd. Morning, 9.00 to 12.00

1. Sketch to approximately ½ inch scale the side of a room 20 feet long finished with wood panelling in the Tudor manner; show a fireplace in the centre of the length of the room and a door near each end.
2. Sketch a similar arrangement to the above with woodwork in the Georgian manner.
3. Illustrate by sketches the development in the method of framing wood panels and the variations in forms and employment of panels in English interior decorative woodwork from Tudor times to the end of the 18th century.
4. Illustrate varieties in the decorative employment of timber work in old English buildings, pointing out some structural members which were made special points of decoration.
5. Sketch in perspective a table characteristic of Elizabethan or Jacobean times.
6. Sketch an interesting example of an old English sideboard.

DEPARTMENT OF ARCHITECTURE.

SPECIFICATIONS AND CONTRACTS

Wednesday, April 21st. Afternoon, 2.00 to 5.00

(Arch. 58.)

1. In the basement of a building in the City of Edmonton a brick pier about 2 ft. 4 in. square shews signs of weakness; it is to be replaced by another of the same size but of first class construction. Specify the materials and work.

2. Write the headings for a building contract. (Note: *Do not write clauses in full but simply give a list of the points to be provided for*).

3. A drawing room floor with polished wood finish is required over a span of 20 feet. Specify the whole of the materials including joists and flooring.

Department of Architecture

SANITATION AND HYGIENE

Tuesday, April 20th. Afternoon, 2.00 to 5.00

1. A hotel is to be built in the neighborhood of a lake in a prairie district; in selecting a site what points would you consider to be of importance as regards the health of the future occupants?
2. Sketch the form and describe the purpose and operation of a septic tank.
3. What is the relative wholesomeness for drinking purposes of lake water, river water, well water and rainwater? What defects is each liable to, and how can these be corrected or obviated?
4. What are the precautions taken to prevent sewer gas in drains from making its way into buildings?
5. What materials should be used (a) for soil pipe stacks, (b) for water supply pipes, (c) for traps from baths?
6. From the point of view of health what are the advantages and disadvantages of a hot air system of heating?
7. Twenty-five persons are to be provided for in a room 35'0" x 20'0" x 12'0" high; at what rate should air pass through an inlet of six square feet clear area in order to give a sufficient supply of air?

FACULTY OF ARTS AND SCIENCES.

INTRODUCTORY BOTANY

(Botany 1.)

Friday, April 16th. Afternoon, 2.00 to 5.00

1. Describe with the aid of sketches the method of opening and closing of stomata. What special modifications are present in xerophytic plants for the protection of stomata?
2. Give a description of the life-history of Oedogonium.
3. Describe in detail the method by which a green plant builds up organic food material from inorganic sources.
4. Briefly describe the following structures or organs: (a) phylloclade, (b) cladode, (c) endodermis, (d) periderm.
5. Write a short essay on the effect of soil on the distribution and character of vegetation.

DEPARTMENT OF PHARMACY

Botany 1a

Friday, April 16th. Afternoon, 2.00 to 5.00

1. Compare the typical structure of the flower in the natural orders: Ranunculaceae, Leguminosae and Labiatae.
2. Describe the development and structure of a typical woody dicotyledonous stem.
3. Give an account of the structures to be found in a typical green cell and describe the function of each structure.
4. Compare the structure of the ovule in the Angiosperm and the Gymnosperm. Mention the several kinds of ovules found in Angiosperms.
5. Define the following: (a) ovule, (b) corm, (c) bulb, (d) tuber, (e) endosperm, (f) mycelium. State the function of each structure you describe.

FACULTY OF ARTS AND SCIENCES.

COMPARATIVE ANATOMY AND MORPHOLOGY.

(Botany 51.)

Thursday, April 22nd. Afternoon, 2.00 to 5.00

1. Describe with the aid of sketches the various types of strobili met with in the fossil Equisetales and compare these with their modern representatives.
2. Describe the various stages in the fertilization of the ovule in the Cycadaceae. What structures are present which are not found in the Coniferae?
3. Describe with the aid of sketches the several stages in the elaboration of the sporophyte generation in the Hepaticae.
4. Compare and contrast the several stages in the life history of Ulothrix, Vaucheria and Oedogonium.
5. Give an account of the life-history and means of dispersal of any heteroecious fungus with which you are acquainted.

Faculty of Arts and Sciences.

PHYSIOLOGY AND ECOLOGY

(Botany 52.)

Tuesday, April 20th. Afternoon, 2.00 to 5.00

1. Describe the several physiological types of vegetation caused by the variation in the amount of available water and describe the special modifications found in these types.
2. Write a short essay on the part played by water in the distribution of fruits and seeds. Briefly classify the various types of modifications which produce buoyancy in fruits and seeds.
3. Distinguish between autecology and synecology. Give a concise account of the salient features of any recent research in autecology.
4. Give a general outline of the mose recent theories of photosynthesis and mention some of the arrangements present in cells to secure the optimum illumination of the chlorophyll apparatus.
5. Briefly discuss the effect of the several climatic changes of the Pleistocene period on the distribution of vegetation in the Northern Hemisphere.

FACULTY OF APPLIED SCIENCE

BACTERIOLOGY

Friday, April 16th. Morning 9.00 to 12.00.

1. What conditions are necessary for the proper development of bacteria?
2. How do spores compare with bacteria in their power of resisting injurious influences and of staining? To what is this due?
3. Describe briefly the various methods of sterilization used in the laboratory.
4. What is meant by (a) aerobic bacteria, (b) facultative anaerobic?
5. What precautions should be observed in the collection and transportation of a sample of river water intended for bacteriological examination?
6. Describe briefly the various steps in the plating of a sample of milk in dilutions of 1-100, and 1-1000.

Faculty of Medicine

BIOCHEMISTRY

(Second Year)

Tuesday, April 13th. Afternoon, 2.00 to 5.00

1. Why is there no sedimentation in colloidal solutions?

2. (a) Outline the structural formulae for fats, carbohydrates, and proteins.

   (b) Detail:—(1) the chemical reactions of the monosaccharids.

   (2) the color reactions of the proteins.

   (3) the formation of ester (tri-palmitine) and the soap (potassium palmitate).

   N.B. Palmitic acid $C_{15}H_{31}COOH$. Glycerin $C_3H_5(OH)_3$.

3. Describe the clotting of blood.

4. Discuss urea under the following headings:—

   (a) formula

   (b) site of formation

   (c) amount in blood

   (d) the estimation of the amount in urine.

FACULTIES OF ARTS AND SCIENCES AND APPLIED SCIENCES

CHEMISTRY 1.

Thursday, April 15th. Morning, 9.00 to 12.00

Candidates are requested to answer any six of the following questions. Give equations and formulae wherever possible.

1. (a) State what is meant by the following:—The Law of Constant Proportion; the Law of Combining Weights; Molecular Weight; Atomic Weight; Equivalent.
   (b) What is Avogadro's Hypothesis?

2. What is the cause of "hardness" of water? How can water be softened, both on a small, and on a commercial scale? Give a brief account of the commoner impurities in shallow well waters, and of their relative importance.

3. Discuss the problem of the supply of combined nitrogen. What sources are available?
   Describe the preparation of nitric acid from the atmosphere.

4. Give an account of the occurrence and uses of the salts of calcium. What is the modern explanation of the setting of (a) lime mortar, (b) plaster of paris?

5. (a) What is meant by a "reversible reaction"? Illustrate your answer by reference to the preparation of oxygen, lime, and ammonia.
   (b) What general methods can be used for the preparation of salts?

6. (a) Give an account of the preparation of metallic iron and of steel. What are the common impurities, and how are they removed?
   (b) How is nickel separated from cobalt?

7. What is produced when the following substances are heated:—orthophosphoric acid; ammonium nitrate; sodium bicarbonate; copper cyanide; copper nitrate?

FACULTY OF MEDICINE

ORGANIC CHEMISTRY

(Chem. 3)

Monday, April 19th. Afternoon, 2.00 to 5.00.

Candidates are requested to answer any six of the following questions, and to use structural formulae wherever possible.

1. Compare the properties of the following:
   (1) Phenol with alcohols.
   (2) Ethyl amine with Aniline.
   (3) Ethyl chloride with Chlor benzene.
   (4) Benzene with the saturated hydrocarbons of the paraffin series.
2. (a) Classify the carbohydrates.
   (b) Give the properties of the hexoses.
   (c) State how a pentose may be converted into an hexose, and
   (d) An aldose into a ketose.
3. State how glycerine may be prepared synthetically, and how levulose may be prepared from glycerine.
4. What is formed when the following substances are heated:
   (1) Ammonium acetate.
   (2) Malic acid.
   (3) Calcium acetate.
   (4) Succinic acid.
   (5) Ethyl sulphuric acid ester.
   (6) Lactic acid.
   (7) Malonic acid.
5. (a) Show the relation existing between Urea and Uric acid.

(b) What is the basicity of Uric acid? Explain any peculiarities in this respect.

(c) State how the percentage of Urea may be determined, explaining the reactions involved.

6. (a) Give the structural formula for Ethyl ether.

(b) State what properties are expressed by this formula.

(c) State your reasons for representing Ethyl ether by the above formula, and

(d) Give two methods for preparing this ether.

7. State how five of the following may be prepared:

(1) Chloroform from Ethyl alcohol.

(2) Aniline from Benzene.

(3) Acetic acid from Methyl chloride.

(4) Glycocol from Acetic acid.

(5) Acetaldehyde from Acetic Acid

(6) Phenol from Benzene.

(7) Butyric acid from Malonic acid.

FACULTY OF ARTS AND SCIENCES, AND OF APPLIED SCIENCE

CHEMISTRY 51

Monday, April 19th. Afternoon, 2.00 to 5.00

Note.—Candidates will answer six questions (two in each part), and give equations and formulae wherever possible.

I

1. Give an account of the silicic acids, and of the silicates. Explain the practical uses of sodium silicate.
2. Classify the oxy-acids of phosphorus, and indicate briefly their methods of preparation and relations.

   Compare the oxides of phosphorus with those of antimony.
3. Show how the compounds of lead resemble the corresponding compounds of tin. How do the properties of the carbon group agree with the positions of the elements in the Periodic Table?

II

4. Define and explain "Osmotic Pressure". How can the value of the osmotic pressure of a dilute solution be calculated? Give two examples of different kinds of dissociation; and indicate the evidence for the existence of dissociation in each case.
5. State and explain the fundamental law of Chemical Dynamics. What is the "active mass" of a solid phase, and of a gaseous phase?
6. (a) How can the molecular weight of a liquid be determined approximately?

   (b) Explain the wide divergence of some substances from the simple gas laws.

III

7. (a) State what precautions have to be used when precipitating phosphoric acid with molybdic acid in the estimation of phosphorus in minerals.

   (b) Point out why this preliminary precipitation as ammonium phospho-molybdate is practised.

   (c) How might it be avoided?

8. (a) Give the fundamental principles which have to be observed when washing precipitates.

   (b) What causes the precipitate of iron produced by ammonium hydroxide to be so difficult to wash?

   (c) Why is it necessary to wash this precipitate free from chlorine when determining iron gravimetrically?

   (d) Outline two methods which enable us to determine the percentage of iron in the presence of aluminium.

9. (a) Discuss the use of Phenolphthalein in the titration of (1) weak acids, and (2) weak bases.

   (b) Explain the solution of arsenious sulphide by ammonium hydroxide and its reprecipitation on treatment with hydrochloric acid.

   (c) Point out how the presence of (1) phosphoric acid, (2) citric acid may interfere in the analysis of the iron group.

Faculty of Arts and Sciences

CHEMISTRY 54

Wednesday, April 21st. Afternoon, 2.00 to 5.00

Candidates are requested to answer six of the following questions: four in Part 1, and two in Part 2.

Part 1.

1. What are "transport numbers"? Explain how they are measured practically. Discuss their variation with dilution of the solution.

2. State and discuss Ostwald's Dilution Law.
How are the molecular conductivity and degree of ionization of an electrolyte measured? Outline the precautions to be observed.

3. Show how the E.M.F. of a concentration cell, in which the two electrodes are of the same metal, can be deduced. Indicate some practical applications.

4. Discuss the mechanism of the electrolysis of solutions of salts.
What is "excess voltage"?
Explain the action of the electrolytic rectifier.

5. Give an account of the criticisms that have been directed against the osmotic theory of Nernst.
How far do these criticisms affect the determination of the absolute potentials of electrodes?

Part 2.

6. Discuss the evolution of the idea of a chemical element.

7. What were the most important contributions to the progress of chemistry of the following:—Aristotle; Paracelsus; Cavendish; Lavoisier; Gay-Lussac; Berzelius; Liebig; Laurent; Frankland?

8. Trace the development of the Type Theory of organic Chemistry. What influence had this theory on the idea of the limited combining power of the elements?

FACULTY OF ARTS AND SCIENCES

ORGANIC CHEMISTRY

(Chem. 102)

Tuesday, April 13th. Afternoon, 2.00 to 5.00

Candidates will answer any five of the following questions, and give structural formulae wherever possible.

1. (a) Give a short acount of the progress made in the study of the constitution of the proteins.
   (b) Point out the difficulties investigators have to contend with in the above study.
   (c) Outline a classification of the proteins, and
   (d) Discuss the scope of the field of study in this group of compounds.
2. (a) Outline the history of the synthesis of Indigo.
   (b) Point out the value of Indigo as a dye.
   (c) State what effect, if any, the production of synthetic Indigo has had on the older branch of the Indigo industry.
3. (a) Describe the methods employed for determining the relative position of "substituents" in the nucleus of Benzene.
   (b) Give the factors which influence the position which a radical will occupy when introduced into a Benzene derivative.
   (c) State the conditions which favor:
      1. The substitution by halogens of hydrogen in the Benzene nucleus.
      2. The replacement by halogens of hydrogen in the side chain of the homologues of Benzene.

3. The addition of halogens to the nucleus of aromatic compounds.

4. Discuss the importance of the diazo compounds from:
   (a) The industrial standpoint, and
   (b) The standpoint of a student of organic chemistry.
   (c) State how they are prepared.

5. (a) Describe how the triphenyl methane derivatives may be prepared.
   (b) State the changes in color produced when successive methyl groups are introduced into the amino derivatives of these compounds.
   (c) Define the following terms:—1. Quinonoid structure, 2. leuco base, 3. color base.
   (d) Explain the essential differences in the dyeing of cotton and of woollen fabrics.

6. Compare as far as possible (1) Benzene, (2) Thiophen, (3) Phenol, (4) Naphthaline, (5) Anthracene, and (6) Phenanthrene in regard to:—(a) their reaction with Sulphuric acid, (b) their reaction with Nitric acid, (c) the case with which they form Quinones and (d) the general properties of the latter.

7. Discuss any three of the following subjects:
   (a) The valence of carbon.
   (b) The isomerism of Oximes.
   (c) The constitution of Phthalyl chloride.
   (d) The formation of Benzyl alcohol from Benzaldehyde by treatment with alkalies.

FACULTY OF APPLIED SCIENCE

APPLIED STATICS

(C. E. 1)

Tuesday, April 13th. Afternoon, 2.00 to 5.00

Note—A sketch sheet accompanies this paper.

1. Find the stresses in the truss shown.
2. Find the moment of inertia about the centre of gravity.
3. Demonstrate how to pass an equilibrium polygon through three points.
4. Find the reactions of the beam shown in the figure and the bending at point A, graphically.
5. Plot the bending moment and shearing force curves for the beam shown in question 4.
6. Find reactions and stresses in members, graphically.
7. Write the index stresses and determine the real stresses.

Faculty of Applied Science

MATERIALS OF CONSTRUCTION

C. E. 3

Wednesday, April 14th. Morning, 9.00 to 12.00

1. Describe the processes involved in the manufacture of wrought iron.
2. Classify the methods employed in moulding iron castings and describe one method in detail.
3. Explain the following terms as applied to timber: shear, cross bending, stiffness, hardness, tension and compression.
4. Sketch and describe a tube mill and indicate its function in the manufacture of Portland cement.
5. State what you know of dynamite.
6. What constitutes a good building stone?

FACULTY OF APPLIED SCIENCE

MECHANICS OF MACHINES

(C. E. 4)

Friday, April 16th. Morning, 9.00 to 12.00

1. In a worm and wheel let the pull at F—30 lbs., R=3 ft., diameter of drum—30", and W—4500 lbs., neglecting friction. If the worm has a triple thread, how many teeth must there be on the wheel?

2. Demonstrate the general method of designing a plate cam.

3. Deduce a construction which will express the linear velocity of the piston relative to the cylinder in an oscillating engine in terms of the crank pin velocity, and show how this mechanism can be utilized to give a quick return motion.

4. In a train of five axes a wheel of 96 teeth on the first axis drives a pinion of 12 teeth on the second axis; the second axis makes a turn in 12 seconds while the third axis makes a turn in 5 seconds; the third axis carries a pulley 4 feet in diameter, which drives by a belt a pulley 16 inches in diameter on the fourth axis; the fourth axis turns twice while the fifth axis turns three times. Find the number of turns of the fifth axis for 5 of the first.

5. Two cycloidal wheels are 2-pitch with radial flanks on each, one to have 10 teeth and the other 20 teeth.

   (a) Draw the pitch circles and the describing circles, and then roll the curves for the faces of the teeth.

   (b) If the addendum on each wheel is half an inch and the 10 tooth pinion drives turning R. H., indicate the path of contact.

   (c) How long are the arcs of approach and recess in terms of the pitch?

Faculty of Applied Science

SURVEYING

(C. E. 5.)

Monday, April 19th. Morning, 9.00 to 12.00

1. Describe the transit; what are its adjustments?
2. In the following notes of a compass survey the length and bearing of one course were omitted. Calculate their values.

Sta.	Bearing.	Chainage in chains.
1	S 40° W	17.50
2	N 45° W	22.25
3	N 36° 15' E	31.25
4	N	13.50
5	.....	.....
6	S 8° 30' W	34.25
7	W	32.50

3. Two tangents differing in direction by 32° 45' are connected by a 3° curve to the right starting at chainage 9+67. What is the distance from the beginning of the curve to the intersection of the tangents? Write the notes for the curve, setting up the transit a tsta. 15+00.
4. (a) Describe the method of surveying Dominion Lands, with special reference to the Third System.

   (b) Wherein do the other systems differ from the third system?
5. Describe the monuments used to mark the corners of Townships, Sections, Quarter Sections. How does one mark the corner of a section when it falls in a slough?..
6. Explain the method used in photographic surveying, showing clearly the theory of platting from the prints.
7. Find the actual distance (not necessarily horizontal)

between two points C & D, both on one side of a base AB, given the following data:

Angle BAC = 100° 45′
Angle BAD = 34° 20′
Angle ABD = 118° 16′
Angle ABC = 26° 20′
Altitude of C from A = 26°35′
Altitude of D from A = 45° 40′
AB = 253.6′

Faculty of Applied Science

FOUNDATIONS AND MASONRY

(C. E. 52)

First Paper

Tuesday, April 13th. Morning, 9.00 to 12.00

Note—A sketch sheet accompanies this paper.

1. A limestone rectangular prism is to be tested for compressive strength. If its base is 6 by 6 inches, what minimum height would give the true ultimate strength of the material?
   Angle of repose 33°. Discuss the failure of masonry under a compressive load.
2. Design a small gravity dam 20 feet high. Max. height of water 2 feet above crest. Use 4 sections. Consider only one case.
3. The abutment of a concrete arch bridge is as shown in the sketch. What is the maximum allowable thrust and what should be the width of the footing assuming three-fourths of this thrust to act? Bearing pressure of soil 2½ tons per square foot.
4. A circular stone arch 20 feet wide, span 40 feet, rise 10 feet, is to carry a load of 500 lbs. per square foot. The earth fill is 2 feet at the crown and weighs 100 lbs. per cubic foot. The thickness at the crown is 3 feet, at the springing line 5 feet. Draw the line of resistance for the full live load.

FACULTY OF APPLIED SCIENCE

FOUNDATIONS AND MASONRY

(C. E. 52)

Second Paper

Wednesday, April 14th. Morning, 9.00 to 12.00

Note—A sketch sheet accompanies this paper.

1. Discuss fully piles, pile driving and pile foundations. Make a complete outline of your discussion before writing it.
2. Describe each of the five methods of constructing foundations in semi-liquid soils.
3. The column bases of a building are located as shown. Allowable bearing pressure 2 tons per square foot. Determine the areas of the column footings. Use the Schneider formula.
4. Design a grillage for footing at A. Make a careful sketch giving all dimensions.
5. Design a reinforced concrete footing at A. Compare the cost of this design with the grillage.
   Steel beams, separators, bolts, etc., 3c per pound, beams.
   5c per pound, bolts
   Plain concrete, $6.00 per yard.
   Reinforced concrete, $10.00 per yard (including reinforcement).

FACULTY OF APPLIED SCIENCE

GEODESY

(C.E. 54)

Tuesday, April 13th. Morning 9 to 12.

1. Discuss the shape and dimensions of the Earth.

2. Explain why and how "reduction to center" should be made.

3. Given in the triangle ABC

angle A—32° 45′ error 0°02′
angle B—63° 24 error 0°03′
side a— 579′ error 5′

find the error in the computed area.

4. Adjust the following observation:

angle COP—107° 53′ 00″.07 weight 5
" COA—171° 42′ 02″.18 " 4
" COB—198° 10′ 28″.22 " 6
" POA— 63° 49′ 05″.86 " 2
" POB— 90° 17′ 16″.02 " 3
" AOB— 26° 28′ 04″.54 " 1

5 In the quadrilateral ABCD the station adjustments have been made with the following results:

angle DAC—42° 17′ 15″ weight 3
" BAC—78° 10′ 19″ " 4
" ABD—25° 59′ 54″ " 6
" DBC—46° 45′ 22″ " 2
" BCA—29° 4′ 24″ " 7
" DCA—21° 9′ 53″ " 3
" CDB—83° 00′ 23″ " 5
" ADB—33° 32′ 30″ " 4

Write the condition equations, including the side equation, from which the correlatives are found and show how the correlatives are used to find the most probable values of the angles. Use seven-place logarithms where necessary.

6. Describe and give the details of construction for Babinet's Equal Area Projection.

Faculty of Applied Science

HYDRAULICS (Lectures—First Paper)

(C.E. 55)

Thursday, April 15th. Morning, 9.00 to 12.00.

1. (a) Deduce the expressions for the total pressure and the position of the centre of pressure on a plane surface immersed in a fluid.

   (b) Find the total pressure and the depth of the centre of pressure on a vertical rectangular plane surface 3 ft. by 6 ft. immersed in water, the 3 ft. sides being horizontal, the upper being 1 ft. below the surface of the liquid.

2. A sharp edged circular orifice .08 ft. in diameter, is placed in the vertical side of a vessel 4 ft. below the free water surface which is kept at a constant level by an overflow.

   (a) Find the total discharge if the orifice be opened for five minutes.

   (b) Find the total pressure on the orifice when closed and the reaction exerted by the stream if the orifice be opened.

   (c) If the orifice be opened, what is the H.P. of the issuing stream?

3. Calculate the time required to empty a circular tank 2 feet in diameter through a sharp-edged circular orifice in its bottom, 2 inches in diameter, if the water in the tank be 20 feet deep.

4. A water supply for a municipality is being investigated. It is found that the proposed source delivers water through a sharp-edged contracted weir 2 feet in width with an effective head of 9.6 inches. What population would the supply serve at the rate of 80 Imperial gallons per capita per day? (One Imperial gallon weighs 10 pounds.)

5. What loss of head in feet per mile would be required to overcome the pipe line frictional resistance if the supply in question 4 is delivered as received through a 6 inch pipe? ($f = .02$).

6. A submerged weir 2 feet in height is placed across a conduit 6 feet in width, in which the water is flowing 5 feet deep with a velocity of 3 feet per second. How high will the water rise behind the weir?

7. Show that in the standard short tube the coeffecient of discharge is 0.82. Calculate the effect upon the energy and discharge of a sharp-edged orifice discharging under a head H, if a standard short tube be attached to the orifice.

8. If the diameter of a fire hose be taken as 2½ inches, and its friction coefficient f as .036, find the hydrant pressure necessary to give a discharge of 244 U.S. gallons per minute (velocity in hose 15 feet per second), through 300 feet of hose ending in a nozzle 1½ inches in diameter, with a coefficient of velocity of 0.98.

9. If the stream from the fire nozzle in question 8 be turned upon a fixed plane placed vertically across its path, what constant force can it exert? If the plane were driven in the direction of the water with a velocity of 30 feet per second, what is the useful work done? What is the energy of the stream, and hence what the efficiency of the power producer?

UNIVERSITY OF ALBERTA

FACULTY OF APPLIED SCIENCE

HYDRAULICS (Lectures—Second Paper)

(C. E. 55)

Monday, April 19th. Morning 9.00 to 12.00.

1. A brick lined rectangular conduit 6 feet wide and laid on a grade of 1 in 500 flows 3 feet deep, and empties into a basin 100 feet by 50 feet. How long will it take to raise the water level in the basin 10 feet?

2. Two reservoirs whose difference in water level is 800 feet are connected by a pipe 12 inches in diameter and 3,000 feet in length connected to two pipes one 10 inches in diameter and two miles in length, and the other 6 inches in diameter and 1 mile in length. What will be the flow from the higher to the lower reservoir, and what the flow in each pipe?

3. Discuss the work done by Bazin, Kutter, Manning, and Humphreys in developing a formula for conduit flow.

4. A stream of water delivering 10 pounds per second with a velocity of 20 feet per second impinges on a curved vane and is deflected from its path through an angle of 60 degrees. Find the impulse exerted by the vane and the work done per second (a) if the vane be fixed, (b) if the vane move in the direction of the water with a velocity of 10 feet per second.

5. Deduce two expressions for the useful work per lb of water done in a turbine and show that these expressions are equal assuming the usual turbine equations.

6. In an O. F. impulse turbine

$$r=2,\ r_1=3\text{ft};\ \alpha=45^\circ;\ \phi=90^\circ;\ \beta=30^\circ.$$

The speed of the water at inlet is 100 feet per second. Assuming that there is no loss of energy in shock or friction, find the efficiency and the work done per lb. of water.

7. Water is delivered to an O. F. turbine at a radius of 2 feet with a whirling velocity of 20 feet per second, and leaves in a reverse direction with a whirling velocity of 10 feet per second at a radius of 4 feet. If the linear velocity of the inlet surface is 20 feet per second, find the head equivalent to the work done in driving the wheel.

8. In a centrifugal pump the external diameter of the fan is 2 feet, the internal diameter 1 foot, and the depth 6 inches. Determine the speed and the efficiency of the pump when delivering 2,000 cubic feet per minute against a pressure head of 64 feet, the inclination of the wheels vanes at the outlet surface being 90 degrees, the direction of the water at inlet being 90 degrees, and the lip angle at inlet 38½ degrees.

9. Discuss "water hammer" deducing an expression for the excess dynamic pressure caused thereby. The pressure head at the entrance to a nozzle is 400 feet, when there is no flow, and 200 feet when the water is flowing. The pipe is 1,500 feet in length and the velocity in it is 4 feet per second when the nozzle is in operation. Compute the excess dynamic pressure when the valve is closed in (a) 0.7 sec., (b) 0.3 sec.

FACULTY OF APPLIED SCIENCE

HYDRAULIC LABORATORY

(C. E. 55)

Saturday, April 17th. Morning, 9.00 to 12.00

1. Sketch and describe the Pelton wheel in the laboratory. Plot an efficiency-load curve from the following data:

Output.	Head over inlet.	Q in cu. ft. per sec.
10 h.p.	100 feet	1.1
8	"	1.006
6	"	0.881
4	"	0.705

2. Write an account of your tests on mouthpieces and indicate the values of the discharge co-efficients obtained for mouthpieces which are converging, diverging and parallel.

3. Calculate the discharge coefficient of a 90° Notch from the following data:

Head in feet.	Q incu. ft. per sec.
0.1231	0.0138
0.1012	0.0083
0.0812	0.00474

4. Show how a Venturi meter may be utilized to measure the amount of water passing through a pipe.
Determine the meter coefficient from the following data:

Q	h_1	h_2
0.00535	1.162	0.683
0.00546	1.337	0.850
0.00673	1.723	1.016
0.00693	1.252	0.517

Q—cu. ft. per sec.

h_1 and h_2—Head of water in feet over inlet and throat respectively.

A—0.00922 sq. ft. a—0.001105 sq. ft.

5. Sketch the centrifugal pump in the laboratory. State the readings which must be taken to determine the actual efficiency.
Plot an efficiency—discharge curve for the machine operating at constant speed.

UNIVERSITY OF ALBERTA

Faculty of Applied Science

MECHANICAL ENGINEERING

(C. E. 57)

Tuesday, April 20th. Morning, 9.00 to 12.00

1. Explain the term "Entropy."

   Sketch a temperature-entropy diagram for an engine operating between the limits of pressure 125 lbs. per sq. in. and 3 lbs. per sq. in. gauge and determine the efficiency ratio referred to a Rankine cycle if the engine uses 20 lbs. of dry steam per horse-power per hour. Assume the water to be returned to the boiler at the temperature of the exhaust steam.

2. Distinguish between engine and boiler "horse-power." Determine the plant thermal efficiency if 7500 lbs. of coal be burned for 5000 h.p. delivered per hour. Calorific value of the coal—14000 B.T.U. per lb.

3. Classify steam turbines and sketch one type.

4. Draw an indicator card for a gas engine which operates on the four stroke cycle.
   Determine the thermal efficiency of an oil engine which uses one pound of kerosene oil per B. H. P. per hour. Calorific value of oil—18600 B.T.U.

5. Describe some type of refrigerating plant.

FACULTY OF APPLIED SCIENCE

MUNICIPAL ENGINERING

(C. E. 59)

First Paper.

Monday, April 12th. Morning 9.00 to 12.00.

1. Discuss the following (any three):

   (a) separate vs. combined water carriage sewerage systems,

   (b) sewage disposal by dilution,

   (c) sanitary significance of bacteria in the air of drains and sewers,

   (d) sewer details in regard to manholes, depth, house connections, flushing.

2. Discuss the following (any three):

   (a) tank treatments in sewage disposal,

   (b) intermittent filtration in sewage disposal.

   (c) disinfection of raw sewage and sprinkling filter effluents,

   (d) contact beds.

3. Discuss the following (any three):

   (a) quantity of water required in a public water supply giving amounts for different uses,

   (b) variations in rate of consumption and their effect on design. (Give maximum and minimum requirements for a town of 36,000.)

   (c) slow sand filter details under (1) maximum heads, (2) rates, (3) construction,

   (d) rapid sand filters.

4. Distinguish among the following, discussing each briefly:

(a) hardness and alkalinity,

(b) total and suspended solids,

(c) urea, proteids, carbohydrates, fat,

(d) decomposition and putrefaction.

5. Discuss traffic arrangements for the following sketching cross-sections showing approximate widths, crown, etc.

(a) a main highway adjacent to a city,

(b) a street in a good residential district,

(c) a retail business street in a city of 80,000.

6. Discuss roadway surfaces, stating when each kind might be used, and their approximate cost per square yard. Give a typical cross-section of a down-town business street suitably surfaced.

FACULTY OF APPLIED SCIENCE

MUNICIPAL ENGINEERING
(C. E. 59)
Second Paper.

Saturday, April 17th. Morning, 9.00 to 12.00.

Note—Any data desired may be used. Calculations must be clearly shown and where tables or curves are used these must be referred to and the data used explained. Data lacking may be assumed, but must conform to reasonable conditions and design.

1. What is the minimum grade upon which a 3 ft. 0 in. brick sewer should be laid if acting as:

   (a) the outfall for the sanitary sewage in a separate system;

   (b) a submain in a combined system?

2. What size of brick sewer on a grade of 1 in 500 is required to drain an area of one square mile if the average slope of the ground toward the drain is 1 in 400?

3. Estimate the cost of a portion of a sewerage system, including the cost of manholes suitably spaced on the 6 inch and 8 inch sewers, consisting of 3 miles of 6 inch (average depth, 12 feet), 2 miles of 8 inch (average depth, 14 feet), and ¾ mile of 12 inch (average depth, 16 feet).

4. Estimate the cost of the lateral sewerage system for a combined system required to serve an area of 800 acres.

5. A 6 in. lateral serves a street of average surface elevation 205. Sketch its connection with a main sewer whose invert is at El. 185.

6. Outline the design of a disposal plant whose effluent is to be discharged into a dry drainage channel adjacent to a water supply. The plant is required for a town of 30,000. Details of design are not required, but figures

and sketches are to be shown upon which the detailed design would be based.

7. A source of water supply with a suitable reservoir at El. 500 is three miles distant from the point A of a distributing system covering a rectangle ABCD (AB—5,000 feet, and BC—3,000 feet). Find the size of the supply main which connects with the distributing system at A (El. 190) the point C being at El. 210, and the density of population provided for being 40 per acre.

8. If the distributing system in question 7 consists of 2 miles of 10 inch, 3 miles of 8 inch and 8 miles of 6 inch C. I. pipe, estimate the cost of the supply main and distributing system.

9. Assuming a sand filter consisting of 40 inches of 0.25 mm. sand with an under layer of 20 mm. gravel 16 inches thick, surface of filter 100 feet by 200 feet, main drain in centre and laterals spaced 14 feet centres, design the underdrains so that when the resistance of the bacterial growth is equal to that of the sand layer the rate of filtration will not vary at any point of the filter more than 10 per cent. from the average rate of 3 million gallons per acre per day.

10. ABC is 14,000 feet in length, BC being 4,000 feet. On BC is constructed a rectangle BCDE in which CD is 500 feet in length. If ABCDE represents a distributing system in which ABC is a 10 inch pipe, BED an 8 inch pipe and CD a 6 inch pipe, find the loss in pressure between A and C when 8 fire streams are being drawn off at D and supplied at A. If the water is pumped into the system at A, criticize the design, suggesting suitable sizes.

FACULTY OF APPLIED SCIENCE

RAILROAD ENGINEERING.

(C.E. 61.)

First Paper.

Thursday, April 15th. Morning, 9.00 to 12.00

1. In a compound curve, $T_1 = 850.6$, $R_1 = 2436.7$, $R_s = 1279.2$, $I = 45° 30'$. Find T_s and the angle turned through by each of the curves.

2. (a) Deduce the formula for the theoretical super-elevation on a $\theta°$ curve, the average speed of trains being V miles per hour.

   (b) Give reasonable values for super-elevation as used in standard practise. Give also reasons for using super-elevation on curves.

3. (a) Deduce formulae for the ordinate and central angle of a cubic spiral of length "l" running into a curve of radius "R_c".

   (b) Calculate the ordinate and central angle of a spiral running into a 3° curve. Average speed of trains 40 miles per hour, and rate of change of super-elevation ½ in. per rail length.

4. (a) Deduce the expression for the radius of a turn-out curve from straight track, given the frog no., the length and offset of switch rail, and the gauge.

   (b) Deduce the expression for the radius of the modified reference curve on main track of radius "R", and gauge "g", using frog no. "n".

5. (a) Define the "mass diagram", and indicate its use as applied in Railroad Engineering.

   (b) What are the two formulae most used in calculating Earth-work, and what are their relative values?

Faculty of Applied Science.

RAILROAD ENGINEERING.

(C. E. 61.)

Second Paper.

Thursday, April 22nd. Morning, 9.00 to 12.00

1. Discuss fully the effects of distance on the profits of a railroad.
2. Discuss rise and fall, and its effect on operating expenses.
3. Plot a curve showing the variation in speed of a train travelling over a road whose profile is shown in the accompanying sketch. Maximum allowable speed 50 miles per hour, minimum allowable speed 15 miles per hour, initial speed 30 miles per hour; draw-bar pull remains just enough to overcome friction. What would be the Virtual Profile if there were a stop at sta. 276+00, the speed decreasing gradually from sta. 266 +00? Find the maximum allowable increase in the descent between A and B, and in the ascent between B and C without interfering with the operation of the division as a virtual level grade.
4. Explain the action of a 4-wheel truck, running round a curved track, and deduce the theoretical curve resistance. Show how rail wear is affected by curvature.
5. Explain clearly how a reconnaissance survey should be made, indicating the principal points to be observed in making such a survey.
6. Describe briefly the elements required to form a divisional railroad yard.

FACULTY OF APPLIED SCIENCE

STRUCTURAL DESIGN

(C. E. 62)

Friday, April 16th. Morning, 9.00 to 12.00

Note.—A sketch sheet accompanies this paper.

1. Design columns to carry a load of 65,000 lbs. Column fixed at both ends, 25 feet long,—one design to be of wood, the other to be of steel.
2. Design a plate girder of 30 foot span to carry a load of 200,000 lbs. per foot.

   Figure—web, flanges, rivet pitch at end, and design end stiffeners.
3. Design and sketch a complete detail for a web splice of a plate girder having the cross section shown in sketch.
4. Outline the organization of a structural drafting room. Make a shop drawing for the beam A in sketch.

Faculty of Applied Science

STRUCTURAL DESIGN

(C. E. 63b)

Friday, April 16th. Morning, 9.00 to 12.00

1. What important considerations should be observed in the design of rivetted joints for truss bridges? Determine the thickness of the connection plate for the connection shown in the sketch.
2. What are the advantages and disadvantages of high office buildings? Describe the three general types of building construction. For what kinds of buildings are they used?
3. Make detailed sketches of two types of fire proof construction. What are the requirements and the desirable qualities of a good floor?
4. How are columns arranged in a building? In what two ways are columns spliced and how is the splicing arranged? Sketch three cross sections of columns to be used in a high building at the same position through each story.
5. Design the floors, beams and columns for the top floor of a three story warehouse 50 x 150 feet to carry a load of 300 lbs. per square foot of floor.

FACULTY OF APPLIED SCIENCE

TESTING LABORATORY
(C. E. 66)

Wednesday, April 21st. Morning, 9.00 to 12.00

1. State the tests that should be applied to building brick which are to be exposed to the weather.
2. Write a short specification for Portland Cement, incorporating the requirements of the Can. Soc. C. E.
3. Describe with sketches the behavior of steel tubes under a compressive load, and indicate the relation of your results to theoretical values.
4. Outline briefly your tests on reinforced concrete beams and compare the results with those of tests C-100-4.
5. Give an account of your tests on reinforced concrete columns.

Faculty of Applied Science

THEORY OF STRUCTURES

(C. E. 67)

First Paper

Monday, April 12th. Morning, 9.00 to 12.00

Note—A sketch sheet accompanies this paper.

1. Define elastic limit, modulus of elasticity and resilience. Show that the intensity shearing stresses on two planes at right angles are equal, and equal to the normal stress on a plane at 45° to either of the other planes.

2. Discuss fully the subject of distributed stresses for the following cases:

   (a) uniform stress,

   (b) uniformly varying stress.

   Show that the moment of a couple is equal to the product of the moment of inertia of the area about the neutral axis and the intensity stress at a unit distance from the neutral axis.

3. A wheel mounted on a horizontal shaft has four projecting arms on which are square vanes as shown. The wheel has 70 r.p.m. The air pressure on the vanes is given by the formula $P = .0030\ V^2 A$, where P is in lbs., V is in feet per sec., and A is in square feet. Weight of steel, 490 pounds per cubic foot. Find the maximum stress at section A-A. Do not neglect the centrifugal force.

4. What angle will the vanes make during rotation with the radial line of the arm before rotation?

5. What diameter of shaft will be required in problem No. 3, assuming f_s=8,000 lbs. per square inch?

6. An hydraulic elevator has a lift of 30 feet and carries a load of 8 tons. If the speed is raised from 0 to 3 feet per second uniformly in 6 seconds, of what diameter should be the shaft of the plunger? A factor of safety of 10 is required.

UNIVERSITY OF ALBERTA

FACULTY OF APPLIED SCIENCE

THEORY OF STRUCTURES

(C. E. 67)

Second Paper

Wednesday, April 14th. Morning, 9.00 to 12.00

Note—A sketch sheet accompanies this paper.

1. An angle is fastened to an I beam as shown in the sketch.
   If the force of 30,000 lbs. is assumed to act through point A shown in plan and elevation. Compute the maximum intensity stress caused in the I beam.

2. A flitched beam is as shown. Find the maximum stress in both the steel and the wood.

3. Design a reinforced concrete column 10 feet long to carry a load of 100,000 lbs. If after one year the concrete contracts, what will be the stress in the steel, and in the concrete at that time?

   Coefficient of contraction, .0004.
   Coefficient of expansion of concrete, .0000055 per degree F.
   Coefficient of expansion of steel, .0000065 per degree F.

   If there is an increase in temperature of 80° F, what will be the stresses in the steel and the concrete?

4. The equations of displacement for combined tension and torsion are:

$$u = +\alpha x$$

$$v = -\beta y - z x \frac{\theta}{\lambda}$$

$$w = -\beta y + y x \frac{\theta}{\lambda}$$

   Derive the formula for the maximum stress.

FACULTY OF APPLIED SCIENCE

WATER POWER ENGINEERING

(C. E. 68)

Monday, April 19th. Afternoon 2.00 to 5.00.

Note.—Question 5 is rated as equal to two of the other questions.

1. Discuss rainfall and evaporation. Give approximately the distribution of the rainfall throughout Canada.
2. Outline the factors affecting the run-off of a given watershed, discussing the features and relative importance of each.
3. Discuss any one of the following: (*Students must not write on the subject for which they were responsible in class discussion.*)
   (a) The Winnipeg City hydraulic power development,
   (b) hollow dams,
   (c) Bow river power and storage possibilities.
4. Discuss methods of water power development indicating when each would be most suitable.
5. In the accompanying sheet is shown a watershed. Precipitation data for three years and average water surface evaporation is also given. Tabulate the probable monthly run-off in square-mile-inches. What storage capacity would be required to guarantee a minimum flow of 500 second-feet? During what time will the storage be drawn upon? What maximum rate of supply could be expected without storage? Ten per cent. of the watershed is water surface, and the rest mainly farm and grazing land.

Faculty of Applied Science

DESCRIPTIVE GEOMETRY.
(Drawing 4.)

Thursday, April 15th. Afternoon, 2.00 to 5.00

One problem may be omitted.

1. An irregular triangle is given by A($2\frac{1}{2}+1-2$) B($4+1\frac{1}{2}-1$) C($4\frac{1}{2}+\frac{1}{2}-2\frac{1}{2}$). Find the traces of the plane in which it lies. Shew the traces of a plane which is at right angles to this plane and contains the point E(3+3—3).

2. A line MN drawn at 45° to XY is the H trace of an oblique plane the inclination of which to H. P. is 60°. Find the V trace. In this plane locate a point A 1 inch from H.P. and 1 inch from V.P. This point is the centre of a square-based pyramid which rests on the plane with one side of the base, 1.5 inches, parallel to MN. The height of the pyramid is 2 inches. Shew its projections.

3. A pentagonal prism, length 3 inches, side of pentagon 1 inch, lies with a rectangular face in an inclined plane of 45° to H.P. The longer rectangular sides have an inclination of 20° to H.P. Shew the prism in projection.

4. An octagonal pyramid, height 3 inches, side of octagon 1 inch, rests on H.P. with one side of the base at 30° to XY. An inclined section plane at 45° to H.P. passes through the centre of the axis. Shew the section and develop the frustum.

5. A right cone, 3 inches high, with a base diameter of 2.5 inches, rests with its base on H.P. and its axis 1′5 inches from V.P. A point S is taken on the front surface 2.5 inches from the vertex and ¾ inch in front of the vertical plane parallel to V.P. through the axis. Shew the projections of a sphere of 1.5 inches diameter tangent to the cone. Find the traces of two planes tangent to the cone and sphere.

6. The axis of a right cone, having a base diameter of 2 inches at A, is given by A(3+1—$\frac{1}{2}$) B(3+1—3). Show the projections of the cone and the traces of a plane tangent to the cone and parallel to a line from M(1+2—2) inclined at 30° to V. P. and 45° to H.P.

7. A right cylinder, base diameter 1.5 inches, height 3 inches, rests on H.P. It is penetrated by a 1 inch square prism whose axis is horizontal, inclined at 30° to V, and passing through the centre of the axis of the cylinder. The rectangular faces of the prism are inclined at 45° to H. Shew the line of intersection.

8. A square block, side of square 2 inches, height of block 1 inch, rests on H.P. with one side at 30° to V.P. On it rests a hexagonal prism, height 2 inches, side of hexagon 1 inch, one face being parallel to V.P. The axis of the solids are in a straight line 2 inches from V.P. Shew the shadows cast on H.P. and V.P. when the rays are at 45° to both planes.

9. A cube of 2 inches side is pierced by a 1 inch cylinder 3 inches long. The centre of the axis passes through the centre of the cube. The ends of the cylinder are parallel to two faces of the cube. Shew these in axometric projection, the axis making angles of 105°, 120°, 135°.

Faculty of Arts and Sciences

ECONOMICS 51.

Thursday, April 15th. Afternoon, 2.00 to 5.00

1. What is value, and what determines it?
2. Discuss Gide's threefold division of labor and explain the part labor plays in production.
3. Give a sketch of the Canadian banking system and estimate its efficiency.
4. "Protection cannot be defended on economic grounds, but may be justified for other reasons." Discuss.
5. What is rent?
6. "Interest, formerly condemned, is now accepted without question." Discuss.

FACULTY OF ARTS AND SCIENCES

EDUCATION 51.

Saturday, April 17th. Morning 9.00 to 12.00

Answer eight questions only.

1. Discuss: distribution of repetitions in learning, the rate of forgetting, individual differences in the curve of fatigue, the characteristics of the learning curve.

2. What individual differences are revealed by the association test? Discuss its actual or posible value (a) as diagnostic, (b) in vocational guidance, (c) in education proper.

3. Discuss feeling under the following heads: (a) psychological theories, (b) individual differences, (c) possibility of training with special reference to aesthetic feelings, (d) effect on work, (e) danger of suppression.

4. What values are essential in reporting individual differences within a group? What advantages has the graphic representation of these values over their numerical statement? Illustrate.

5. Discuss the "Single Type" vs. "The Multiple Type" theory, with special reference to the distribution of intelligence. Classify intelligences, giving the Binet age equivalents for the lower "types". Is the distribution correctly represented by the classification?

6. What are the chief advantages of a "point scale method" for measuring mental capacity in comparison with the Binet-Simon "Age Scale" method?

7. Discuss the aims and prospects of eugenics under the two headings: (a) negative, and (b) positive eugenics.

8. How could you determine the nature of the individual with respect to the following traits: Type of Attention, Suggestibility, Fatigability, Rapidity of reaction, Memory, Apperception?

9. Outline briefly the points of chief importance in the *special topic* you have studied.

Faculties of Arts and Sciences and Applied Science

ENGLISH 1.

Wednesday, April 14th Morning, 9.00 to 12.00

1. Contrast the pictures of town and country life which are given in the Spectator.
2. Compare the aims and methods of the Spectator and Gulliver's Travels.
3. What is Swift's attitude in Gulliver's Travels towards war, politics and science?
4. Give an analysis of Burke's speech on Conciliation, showing the effectiveness of its structure.
5. Write notes on the following:—
   (a) Will Honeycomb and Moll White.
   (b) Burke's use of quotation.
   (c) Burke's conservatism.
6. Give the story of Wordsworth's "Michael."
7. Compare Keats's "Eve of St. Agnes" and Burns's "Tam O'Shanter" as types of narrative poems.

FACULTY OF ARTS AND SCIENCES

ENGLISH 2.

Monday, April 12th. Morning, 9.00 to 12.00

1. Rearrange the following list of authors in chronological order: Coleridge, Dekker, Caedmon, Keats, Spenser, Fielding, Chaucer, Byron, Bacon, Burns, Tennyson, Addison, Shakespeare, Marlowe.

2. Write a *brief* account of each of the authors in the foregoing list, being careful to preserve the proper chronological order, and confining yourself to: (1) the period in which they wrote, (2) their most important works, (3) a brief statement of their literary significance.

3. (a) What is a ballad? (b) At what period were the ballads composed? (c) When, and under what circumstances, were they revived? (d) Name three of them.

4. Place each of the following quotations, and describe the context of the quotation:

   (a) "Was this the face that launched a thousand ships,
   And burnt the topless towers of Ilion?"

   (b) "Revenge is a kind of wild justice."

   (c) "Go, draw aside the curtains and discover
   The several caskets to this noble prince."

   (d) "A while after was revived an old fashion, long antiquated, of embroidery with Indian figures. . . . They did not wear them in that sense, as forbidden by their father, but as they were a commendable custom, and of great use to the public. That these rigorous clauses in the will did therefore require some allowance and a favourable interpretation, and ought to be understood *cum grano salis.*"

   (e) "E'en there, before the fatal engine closed,
   A wretched sylph too fondly interposed;
   Fate urged the shears, and cut the sylph in twain."

(f) "I talked of the numerous reflections which had been thrown out against him, on account of his having accepted a pension from his present majesty. "Why, sir," said he with a hearty laugh, "it is a mighty foolish noise that they make. I have accepted of a pension as a reward which has been thought due to my literary merit; and now that I have this pension, I am the same man in every respect that I have been."

(Write a brief sketch of the speaker. Comment on the "pension.")

(g) "My muse, though hamely in attire,
May touch the heart."

(h) "There was a time when meadow, grove and stream,
The earth, and every common sight,
To me did seem
Apparelled in celestial light."

(i) "He prayeth best, who loveth best
All things both great and small;
For the dear God who loveth us,
He made and loveth all."

(k) "That which we are, we are;
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, but not to yield."

FACULTY OF ARTS AND SCIENCES

ENGLISH 51

Monday, April 12th. Morning, 9.00 to 12.00.

1. Trace briefly the literary influences of which Wordsworth's "Preface to the Lyrical Ballads" is the result.
2. Contrast the circumstances of Browning's life with Tennyson's, and differentiate the general tone and content of their poetry accordingly.
3. Compare "In Memoriam" and "La Saisiaz."
4. Name and very *briefly* describe the poems from which the following excerpts are taken:

(a) "Oh, sir, she smiled, no doubt,
Whene'er I passed her, but who passed without
Much the same smile? This grew; I gave commands;
Then all smiles stopped together."

(b) "When.....Nature, prized
For her own sake, became my joy, even then....
Was man in my affections and regards
Subordinate to her, her visible forms
And viewless agencies: a passion, she,
A rapture often."

(c) "The sounding cataract
Haunted me like a passion; the tall rock,
The mountain, and the deep and gloomy wood,
Their colours and their forms, were then to me
An appetite; a feeling and a love,
That had no need of a remoter charm,
By thought supplied."

(d) "Ah, great and gentle lord....
To whom my false voluptuous pride, that took
Full easily all impressions from below,
Would not look up, or half despised the height
To which I would not or I could not climb—

I thought I could not breathe in that fine air,
That pure severity of perfect light."

(e) "The Book! I turn its medicinable leaves
In London now till, as in Florence erst,
A spirit laughs and leaps through every limb."

(f) "Upon the side
Of Hellespont (such faith was entertained)
A knot of spiry trees for ages grew
From out the tomb of him for whom she died."

(g) " 'Tis believed by all
That many and many a day he thither went
And never lifted up a single stone."

(h) " 'Ay, but you don't so instigate to prayer!'
Strikes in the Pryor; 'when your meaning's plain
It does not say to folk—remember matins,
Or, mind you fast next Friday!' Why, for this,
What need of art at all?"

(i) "This high man with a great thing to pursue
Dies ere he knows it."

(k) "And on the glimmering limit far withdrawn
God made Himself an awful rose of dawn."

5. Give a brief outline of Carlyle's life.

6. Comment briefly on (a) The French Revolution, (b) Cromwell, (c) Heroes and Hero Worship. What point of view is traceable through all three?

7. *Sartor;*

(a) Trace the origin and growth of the theory to which Carlyle gives final expression in *Sartor.*

(b) Cite, as explicitly as possible, several applications of the "philosophy of clothes" in *Sartor.*

(c) Describe the "romance" of Herr Teufelsdroeckh.

(d) Comment fully on Carlyle's style as illustrated in *Sartor.*

FACULTY OF ARTS AND SCIENCES

ENGLISH 52.

Wednesday, April 21st. Afternoon, 2.00 to 5.00

1. Write an essay on Malory's "Morte Darthur," including in your discussion:
   (a) a condensed account of the origins and development of the "Matter of Britain";
   (b) a brief description of Malory's book;
   (c) a comment on the circumstances which contributed to its popularity and influence.
2. Describe fully one Elizabethan work of prose fiction.
3. Trace the general and the personal influences which contributed to the work of Richardson as a novelist.
4. Give a brief outline of the subject matter, and comment on the significance, of "Caleb Williams."
5. Trace briefly the beginnings of the "historical novel", and briefly describe "Kenilworth".
6. Indicate the most significant points of contrast between (a) Jane Austen and George Eliot; (b) Dickens and Thackeray.
7. Place the following characters: (a) Steerforth, (b) Eustacia Vye, (c) Elizabeth Bennett, (d) Amy Robsart, (e) Dametas, (f) Partridge, (g) Corporal Trim, (h) Colonel Dobbin, (i) Lucy Desborough, (k) Mr. Thornhill.

Faculty of Arts and Sciences

ENGLISH 102

Monday, April 19th. Morning 9.00 to 12.00.

1. State briefly the ascertained facts of Shakespeare's life.
2. What was Shakespeare's attitude toward the actor's profession? (Specify the passages on which you base your answer.)
3. Describe each of the following plays in respect to (a) the dramatic type to which it belongs; (b) the source or sources; (c) the substance of the story; (d) the dramatic technique:
   (1) Henry IV. Part I.
   (2) Love's Labors Lost.
   (3) Twelfth Night.
   (4) Macbeth.
4. Compare and contrast "Midsummer Night's Dream" and "Hamlet."
5. Comment on "Hamlet" in relation to its sources.
6. Comment on the art of (a) Marlowe, (b) Jonson, (c) Dekker, (d) Heywood, illustrating in each case by a play by the given author.
7. Discuss the literary problems arising out of the co-operation of Beaumont and Fletcher.

FACULTY OF APPLIED SCIENCE

ELECTRICAL ENGINEERING 53

Friday, April 23rd. **Morning, 9.00 to 12.00**

Only nine questions to be attempted, which must include 9, 10 *and* 11.

1. Explain how the E.M.F. is generated in a dynamo, and derive the equations for the instantaneous and effective E.M.F.

2. (a) Draw the speed curves on a current—input base for shunt, series, and compound D.C. Motors.
   (b) Show diagram of connections for each type.
   (c) What is the best type to use for (i) constant speed line shaft, (ii) crane, (iii) traction? Give reasons.
   (d) How is the speed of a shunt motor varied in the multiple voltage system?

3. Explain armature reaction and draw typical curves of flux distribution around the armature of a generator (a) at no load, (b) at full load with the brushes advanced. How does it affect commutation?

4. What are the advantages of parallel operation of generators? A and B are two compound generators operating in parallel. If A is in operation, show how B is brought in to share the load. Explain how the equalizer makes them stable.

5. Batteries are supplied to take the peak-loads in a power-house. If the line voltage must be kept constant, explain how the batteries may be charged.

   (b) Explain with diagram the battery connection in the differential booster for rapidly fluctuating loads.

6. Explain the operation of the synchronous motor. How can it be made self-starting? How can it be used to improve the power-factor of a line?

7. A balanced load on a 2200 volt. three-phase line consists of 1800 one-half ampere, 110 volt lamps and a 200 H.P. 3-phase motor, with a P.F. of 80 per cent. and an efficiency of 88 per cent. The transformers supplying the motor are delta connected. Draw the diagram of connections and find the ratings of the transformers, the current in the mains, and the resultant power factor.

8. How is the torque developed in a polyphase induction motor? What are the two principal types, and how do they differ? How would you change the direction of rotation of these motors?

9. A single phase transmission line 10 miles long has a resistence of 0.2 ohms per mile of wire and a reactance of 0.3 ohms per mile of wire at 60 cycles. The power taken at the receiver end is 3000 k.w. at 12,000 volts and 80 per cent. P.F. Find the voltage and power factor at the generating station and the energy-loss in the line.

10. What are the principal electric railway systems now in use? State the class of work for which each is suited. Sketch and describe the layout of a 600 volt. D.C. traction system.

11. Compare the following lamps with regard to life, color, and efficiency:
    (a) Tungsten and carbon filament; open and enclosed D.C. arcs; open and enclosed flame arcs. Which would you use for the lighting of (a) country roads, (b) city streets, (c) factories, (d) residences? Give reasons for your answer.

FACULTY OF MEDICINE.

EMBRYOLOGY.

Wednesday, April 14th. Afternoon, 2.00 to 5.00

Answer any four questions.

1. Briefly trace the history and fate of the Wolffian duct in mammals.
2. Trace the history of the yolk-sac in the chick. What becomes of it in:
   (a) the chick,
   (b) mammals?
3. Describe the development of the heart in the mammalian embryo.
4. What structures are attached to the umbilicus and what are their embryological origin and function?
5. Briefly describe the organogeny of the mammary gland.
6. Give a brief account of the embryology of the midgut and the hindgut.

Faculty of Arts and Sciences

FRENCH

Thursday, April 15th. Morning, 9.00 to 12.00.

1. Translate into French:

   (a) They accepted the favours of the queen.

   (b) Pass me my comrade's book, if you please.

   (c) When shall we decide?

   (d) How many pupils have we in the class?

   (e) We have six boys and nine girls.

   (f) Has not the servant burned my brother's letters?

   (g) That he may know.

   (h) When will you answer your friend's letters?

   (i) Do you hear the noise of the street?

   (j) What time is it? It is five minutes past three.

2. (a) Conjugate all the simple tenses of *rendre* in the first person singular and first person plural.

   (b) What are the peculiarities of verbs ending in *cer* and *ger?*

   (c) What are the peculiarities of verbs ending in *eler* and *eter?*

   (d) What are the peculiarities of verbs ending in *yer*. State in which tenses the peculiarities occur and give one instance for each verb.

   (e) What tense is derived from the Present Indicative, and how? Give a complete example for first, second and third conjugations.

   (f) Give the French of the following familiar phrases and idioms:

   How do you do? (two ways)

   Pretty well, thank you.

Hurry up!—What are you thinking of? You are late.

How old are you? I am twenty-one.

3. Put into English:

(a) En voyant entrer son fils, il avait croisé les jambes, et avait posé le coude droite sur le bureau. Il examinait curieusement le grand et joli homme mince, son fils, qui s'asseyait en face de lui, et il souriait de cette façon toute physique et impertinente qui était la sienne, à ne consulter que ce visage plein, encadré de deux favoris gris, et que le geste de la main droite, relevée, touchant la tête et jouant avec le cordon d'un lorgnon, il eût été facile de comprendre l'erreur de ceux qui prenaient M. Joseph Oberlé pour un magistrat.

(b) Jean sortit, traversa le chanties, passa devant la porterie et prit la route de la forêt. Il avait l'âme en fête. Malgré la lumière triste, malgré les nuages et le vent, il trouva belle, divinement belle, son Alsace qui descendait en pente très douce devant lui, et devenait bientôt une plaine tout unie, avec des bandes d'herbes et des bandes de labours d'où les villages, çà et là, levaient leurs toits de tuile et la pointe de leur clocher.

Faculty of Arts and Sciences

FRENCH 1a.

Tuesday, April 20th. Afternoon, 2.00 to 5.00

1. Translate into English:

Sitôt entré, le premier moutardier salua d'un air galant, et se dirigea vers le haut perron, où le pape l'attendait pour lui remettre les insignes de son grade: la cuiller de buis jaune et l'habit de safran. La mule était au bas de l'escalier, toute harnachée et prête à *partir* pour la vigne...Quand il passa près d'elle, Tistet Védène eut un bon sourire et s'arrêta pour lui donner deux ou trois petites tapes amicales sur le dos, en regardant du coin de l'œil si le pape le *voyait*. La position *était* bonne...La mule prit son élan. "*Tiens*! attrape, bandit! Voilà sept ans que je te le garde!" Et elle vous lui détacha un coup de sabot si terrible, si terrible, que de Pampelune même on en vit la fumée, un tourbillon de fumée blonde où *voltigeait* une plume d'ibis; tout ce qui restait de l'infortuné Tistet Védène!...

(a) Write out in full the past definite tense of the italicized verbs.

(b) Translate into French:

(1) I have been here two weeks.
(2) Here is all that remains of my coat.
(3) He looked at me out of the corner of his eye.

(c) "Tiens! attrappe, bandit! Voilà sept ans que je te le garde!"—Explain briefly and clearly the allusion.

2. Translate into English:

Jeau connut de nouveau l'intime douleur contre laquelle il n'y avait pas de remède. Toute l'après-midi il travailla dans le bureau de la scierie, mais distrait et songeur. Il songea que Lucienne partirait un jour, et que rien ne serait changé; que

le grand-père pouvait disparaître aussi, et que la division n'en subsisteraient pas moins. Tous les projets qu'ils avaient eus, de loin, l'espoir d'être une diversion, d'apaiser, de faire l'union ou une apparence d'union, tout cela lui parut enfantin. Il vit que Lucienne avait dit vrai, quand elle s'était moquée de ses illusions. Non, le mal n'était pas dans sa famille, il était dans toute l'Alsace. Lors même que personne autre de son nom ne vivrait plus à Alsheim, Jean Oberlé rencontrerait à sa porte, dans son village, parmi ses ouvriers, ses clients, ses amis, la même gêne à certains moments la même question toujours. Sa volonté, ni aucune volonté semblable à la sienne, ne pouvait délivrer sa race, ni à présent, ni plus tard.

(a) Translate into French:

(1) Nobody else of his name now lives in Alsace.
(2) Why do you make fun of my illusions?
(3) Nothing will ever be changed.

(b) Describe briefly the chief characters in *Les Oberlé* and the rôles they play.

3. Translate, at sight, into English:

LORSQUE L'ENFANT PARAIT.

Lorsque l'enfant paraît, le cercle de famille
Applaudit à grands cris; son doux regard qui brille
Fait briller tous les yeux,

Et les plus tristes fronts, les plus souillés peut-être,
Se dérident soudain à voir l'enfant paraître,
Innocent et joyeux.

Soit que juin ait verdi mon seuil, ou que novembre
Fasse autour d'un grand feu vacillant dans la chambre
Les chaises se toucher,

Quand l'enfant vient, la joie arrive et nous éclaire.
On rit, on récrie, on l'appelle, et sa mère
Tremble à le voir marcher.
Quelquefois nous parlons, en remuant la flamme,
De patrie et de Dieu, des poètes, de l'âme
Qui s'élève en priant;

L'enfant paraît, adieu le ciel et la patrie
Et les poètes saints! la grave causerie
S'arrête en souriant.

FRENCH 1b.

Note.—Students will write French 1b in a separate examination book.

1. Translate into French:
   (1) As for me, I should prefer to do without it (s'en passer).
   (2) Have you any matches? I have some; how many do you want?
   (3) I should like very much to know what you think about it.
   (4) Why didn't you tell me that sooner?
   (5) By the way, when does the postman come?
   (6) What you say is not true; he has enough to live on.
   (7) This is the gentleman whose son came to see me yesterday.
   (8) There is the shop in which I bought my gloves.
   (9) Tell me who you are, you who are speaking thus.
   (10) Ennui is a disease whose cure is work.
2. Translate the following idiomatic and grammatical phrases into French:
   (1) Don't mention it.
   (2) Just let us see if it is so.
   (3) It is all over with him.
   (6) Who is coming? (two ways)
   (7) Whom did you see? (two ways)
   (8) What makes you sick?
   (9) How happy I am!
   (10) This day week.
3. Write in full, Indicative Present, Past Definite, and Future of:—
   Ecrire, *envoyer*, *faire*, *lire* and *moudre*.

FACULTY OF ARTS AND SCIENCES.

FRENCH 2a

Friday, April 23rd. Morning, 9.00 to 12.00

1. Translate into English:

..Voilà ce que je vois et ce qui me trouble. Je regarde de toutes parts, et je ne vois partout qu'obscurité. La nature ne m'offre rien qui ne soit matière de doute et d'inquiétude. Si je n'y voyais rien qui marquât une Divinitè, je me déterminerais à la négative. Si je voyais partout les marques d'un Créateur, je reposerais en paix dans la foi. Mais, voyant trop pour nier, et trop peu pour m'assurer, je suis en un état à plaindre, et où j'ai souhaité cent fois que, si un Dieu la soutient, elle le marquât sans équivoque; et que, si les marques qu'elle en donne sont trompeuses, elle les supprimât tout à fait; qu'elle dit tout ou rien, afin que je visse quel parti je dois suivre.

(a) Who is the author? Describe the work from which the foregoing citation is taken.

(b) How is the passage characteristic of the author?

2. (A) Translate into English:

Je puis vous dissiper ces craintes ridicules,
Madame, et je sais l'art de lever les scrupules.
Le Ciel défend, de vrai, certains contentements;
Mais on trouve avec lui des accommodements;
Selon divers besoins, il est une science
D'étendre les liens de notre conscience,
Et de rectifier le mal de l'action
Avec la pureté de notre intention.
De ces secrets, Madame, on saura vous instruire;
Vous n'avez seulement qu'à vous laisser conduire.
Contentez mon désir, et n'ayez point d'effroi:
Je vous réponds de tout, et prends le mal sur moi.
Vous toussez fort, Madame.

(a) Who is the speaker and from what work is the foregoing quoted?

(b) Comment on the content of the passage.

(B) Cléante:—Laissez aux libertins ces sottes conséquences;
Démêlez la vertu d'avec ses apparences,
Ne hasardez jamais votre estime trop tôt,
Et soyez pour cela dans le milieu qu'il faut:
Gardez-vous s'il se peut, d'honorer l'imposture,
Mais au vrai zèle aussi n'allez pas faire injure;
Et s'il vous faut tomber dans une extrémité,
Péchez plutôt encor de cet autre côté.

(a) Write a note regarding the point of view of Cléante and the significance of this mood generally in Molière's work.

3. Translate into English:

Je me suis accusé de trop de violence;
Et la beauté, sans doute, emportait la balance,
A moins que d'opposer à tes plus forts appas
Qu'un homme sans honneur ne te méritait pas;
Que, malgré cette part que j'avais en ton âme,
Qui m'aima généreux me haïrait infâme;
Qu'écouter ton amour, obéir à sa voix,
C'était m'en rendre indigne et diffamer ton choix.
Je te le dis encore, et, quoique j'en soupire,
Jusqu'au dernier soupir je veux bien le redire:
Je t'ai fait une offense, et j'ai dû m'y porter
Pour effacer ma honte, et pour te mériter;
Mais, quitte envers l'honneur, et quitte envers mon père,
C'est maintenant à toi que je viens satisfaire:

(a) Who is the speaker?

(b) Explain what is meant by saying that: "*Le Cid* est un débat."

(c) Scan the first two lines.

(d) What is meant by "The Unities"?

4. Translate, at sight, into English:

SONNET A M. LA MOTHE LE VAYER.

Aux larmes, Le Vayer, laisse tes yeux ouverts:
Ton deuil est raisonnable, encor qu'il soit extrême;
Et, lorsque pour toujours on perd ce que tu perds,
La Sagesse, crois-moi, peut pleurer elle-même.

On se propose à tort cent préceptes divers
Pour vouloir d'un oeil sec voir mourir ce qu'on aime;
L'effort en est barbare aux yeux de l'univers,
Et c'est brutalité plus que vertu suprême.

On sait bien que les pleurs ne ramèneront pas
Ce cher fils que t'enlève un imprévu trépas;
Mais la perte, par là, n'en est pas moins cruelle.

Ses vertus de chacun le faisaient révérer;
Il avait le coeur grand, l'esprit beau, l'âme belle;
Et ce sont des sujets à toujours le pleurer.

FRENCH 2b

Note.—Students will write French 2b in a separate examination book.

1. Traduisez en français:

(a) An Ambiguous Compliment

There was at Ferney a theater where they performed the tragedies of Voltaire. The parts were played by the guests. Madame Denis, the niece of Voltaire, almost always took part in these performances. She had just played the rôle of Zaire, when a gentleman from the neighborhood came up to her and complimented her very highly on her dramatic talent.

"In order to fill this rôle suitably, one ought at least to be young and pretty," said Madame Denis with feigned modesty.

"Ah, Madame," answered the gentleman naïvely, "you have certainly proved the contrary." And he went off delighted with the compliment he imagined he had paid her.

(b) Bold Answer of a Calvinist Officer to Louis XIV.

When they wanted to abolish Calvinism in France, Louis XIV dismissed an officer in his body-guard who professed that religion. The officer, who had received several wounds in the service of the monarch, said to him: "Sire, when I was sent to fight the enemy, I wasn't asked what my religion was; they thought that a Huguenot would serve you as well as a soldier of your religion."

"I am satisfied with your services," answered Louis XIV, "but the God that I serve is not satisfied, and it is he who dismisses you."

"Pardon me, Sire," replied the officer, "it is not God, it is your religion."

2. Répondez en français aux questions suivantes, et donnez des réponses complètes:

(1) Quels animaux appelle-t-on carnassiers?

(2) Qu'appelle-t-on granivores?

(3) Pour quels animaux emploie-t-on le mot bouche?

(4) Et pour lesquels se sert-on de gueule? Donnez deux exemples pour chaque question.

(5) Quels sont les homonymes de cher? Donnez la signification de chaque exemple en anglais.

(6) De ce que l'homme a deux mains, quel nom lui donne-t-on?

Expliquez en français les gallicismes suivants:

(7) Pattes de mouches.

(8) Faire patte de velours.

(9) Donner un coup de patte à quelqu'un.

(10) Les enfants vont d'abord à quatre pattes.

3. Faites la transcription phonétique des lignes suivantes:—

Un marchand, ayant confié à un conducteur de chameaux un certain nombre de balles de soie, pour les transporter à Constantinople, partit avec lui.

4. Donnez les temps primitifs de devoir, dire, faire et lire, avec l'Indicatif Présent, le Future et le Présent du Subjonctif en entier de devoir et de faire.

Faculty of Arts and Sciences

FRENCH 41

Thursday, April 15th. Morning, 9.00 to 12.00.

1. Translate into French:

(a) They accepted the favours of the queen.

(b) Pass me my comrade's book, if you please.

(c) When shall we decide?

(d) How many pupils have we in the class?

(e) We have six boys and nine girls.

(f) Has not the servant burned my brother's letters?

(g) That he may know.

(h) When will you answer your friend's letters?

(i) Do you hear the noise of the street?

(j) What time is it? It is five minutes past three.

2. (a) Conjugate all the simple tenses of *rendre* in the first person singular and first person plural.

(b) What are the peculiarities of verbs ending in *cer* and *ger?*

(c) What are the peculiarities of verbs ending in *eler* and *eter?*

(d) What are the peculiarities of verbs ending in *yer*. State in which tenses the peculiarities occur and give one instance for each verb.

(e) What tense is derived from the Present Indicative, and how? Give a complete example for first, second and third conjugations.

(f) Give the French of the following familiar phrases and idioms:

How do you do? (two ways)

Pretty well, thank you.

Hurry up!—What are you thinking of? You are late.

How old are you? I am twenty-one.

3. Put into English:

(a) On comprend que les premiers hommes, cherchant à se garantir de l'attaque des bêtes féroces ou des surprises d'un ennemi, aient construit dans les pays lacustres qu'ils habitaient des demeures sur pilotis. Grâce à leurs canots, ils pouvaient se transporter facilement sur tous les points de la côte, et en même temps leurs maisons leur servaient d'habitation de pêche. Peut-être aussi obéissaient-ils à cet invincible attrait exercé par les eaux sur tous les les peuples, en construisant, comme le font aujourd'hui les habitants de la Nouvelle-Guinée, des villages appuyées sur des pieux fichés au fond des lacs.

(b) On ne sait pas ce que l'homme mangeait quand il est sorti des mains de la nature; on ignore s'il était herbivore ou carnivore, mais il est certain que l'habitude ou la nécessité l'ont rendu par la suite herbivore et carnivore. Les débris de la cuisine du Danemark, nous donnent avec une précision absolue le menu des festins primitifs. L'huître comestible est le fonds de la nourriture des hommes antéhistoriques; les poissons, les crustacés vulgaires, les oiseaux aquatiques, les canards et les coqs de bruyère, qui paraisaient souvent encore à leur table, nous donnent une asez bonne opinion de leur instinct gastronomiques.

FRENCH 42

1. Translate:

(a) Rabelais and the Cardinal

Rabelais, while dining one day with a cardinal whose physician he was, struck with his knife on the edge of a plate on which there was a lamprey and said: "That. is very indigestible." The cardinal, who thought a great deal about his health, immediately caused the plate with the lamprey to be taken away. Rabelais had it brought back for himself, and began to eat it as fast as he could. When the cardinal noticed this he said to him: "What, sir, you told me that lamprey was indigestible, and yet you are eating it with such good appetite?"

"You will pardon me," Rabelais answered, "I spoke of the plate, not the lamyrep."

(b) An Unintended Insult

One day when Napoleon was surrounded by some of his principal offieers he received a letter from his father-in-law, the Emperor of Austria. The letter did not please him because it showed that his father-in-law was not complying wiih his wishes. Napoleon always became irritated when peopie did not yield to his will. So he turned toward the Empress and said sharply: "Madame, your father is a blockhead." Marie-Louise did not understand the word, and did not dare to ask for an explanation.

(c) La Misère.

It is a very old story often told on a winter's evening in the thatched cottages of Poland. If you should ask me at what time it happened, I should have to tell you that the old men whom I consulted all replied, shaking their heads, that their grandparents declared that they had heard it related by the oldest people in the country, who

had not been witnesses of the fact themselves, but who had it from their parents. They all, however, believe it to be absolutely true.

2. (a) Give the primitive tenses of:

Partir, paraître, naître, ouvrir.

(b) Conjugate in full: Indicative Present, Past Definite, Future and Subjunctive Present, of *Pouvoir*.

3. Translate into English:

(a) Il la remerciait en la regardant s'asseoir. Il ne regardait pas les autres. Alors, il faisait, seul avec elle, le signe de la croix, étant fils de la vieille Alsace qui priait. Et, servi par cette voisine silencieusement charitable, et qui prévenait ses dérirs, il commençai à manger, lentement, ayant peine à mouvoir le ressort détendu de ses muscles.

(b) Jean ne répondit pas. Lucienne riait encore, quand le grand-père cessa de manger, et péniblement, tourna vers sa petite-fille sa tête blanche et triste. Les yeux du vieil Alsacien devaient avoir un langage bien facile à traduire, car la jeune fille cessa de sourire; fit un geste léger d'impatience comme si elle disait: "Ma foi! je n'ai pas fait attention que vous étiez là!" Aucun des convives n'osait lever la tête dans la direction de l'aieul. M. Philippe Oberlé continuait de fixer, de son regard implacable comme un remords, sa petite-fille coupable d'une parole étourdie et fâcheuse.

Faculty of Arts and Sciences

FRENCH 51a

Wednesday, April 14th. Morning 9.00 to 12.00.

1. The significance—in detail—of *Turcaret,* of *Le Jeu de l'Amour et du Hasard* and of *Le Barbier de Séville* as reflections of the society of pre-revolutionary France.

2. Writing regarding Rousseau's first *Discours, Si le Rétablissement des Sciences et des Arts a contribué á épurer les moeurs,* L. Brunel asserts:

"Du jour au lendemain il (Rousseau) était devenu, non seulement homme de lettres, mais auteur d'une doctrine nouvelle."

Explain the significance of this statement.

3. Translate, identify and comment on the significance of the following passage:

(a) A voir ce que l'on fut sur terre et ce qu'on laisse,
Seul le silence est grand; tout le reste est faiblesse.

* * * * * * * *

Gémir, pleurer, prier est également lache.
Fais énergiquement ta longue et lourde tâche
Dans la voie où la sort a voulu t'appeler,
Puis après, comme moi, souffre et meurs sans parler.

(b) Ils prirent à témoin de leur joie éphémère
Un ciel toujours voilé qui change à tout moment,
Et des astres sans nom que leur propre lumière
Dévore incessamment.

* * * * * * * *

Et sur tous ces débris joignant leurs mains d'argile,
Etourdis des éclairs d'un instant de plaisir,
Ils croyaient échapper à cet Etre immobile
Qui regarde mourir!

4. Translate at sight into English:

Sois sage, ô ma Douleur, et tiens-toi plus tranquille.
Tu réclamais le soir; il descend; le voici;
Une atmosphère obscure enveloppe la ville,
Aux uns portant la paix, aux autres le souci.

Pendant que des mortels la multitude vile,
Sous le fouet du Plaisir, ce bourreau sans merci,
Va cueillir des remords dans la fête servile,
Ma douleur, donne-moi la main; viens par ici,

Loin d'eux. Vois se pencher les défuntes Années,
Sur les balcons du ciel, en robes surannées;
Surgir du fond des eaux le Regret souriant;

Le Soleil moribond s'endormir sous une arche,
Et comme un long linceuil traînant à l'orient,
Entends, ma chère, entends la douce Nuit qui marche.

—Charles Baudelaire.

FRENCH 51 b

NOTE: *Students will write French 51 b in a separate examination book*

1. Traduisez en français:

(a) A hardware merchant was offering for sale a patented apparatus, which, according to its inventor, would enable the purchaser to reduce the consumption of gas to one half. A peasant, who had just settled in the town, entered and asked for explanations. "Very good," he said after a few moments, "send me two of these affairs, for I don't want to burn any of their dirty gas, at all."

(b) Dean Swift's cook served him one day a leg of mutton too much done. He sent for her and told her to take the leg back again and do it less. "Please your honor," said she, "I can't do it less."...."But, replied the Dean, "if it had not been done enough, you could surely have done it more, could you not?"—"To be sure, sir; very easily."—"Why, then," said the Dean," in future when you commit a fault, let it be such a one as can be mended."

2. Narration: "Le Premier Ane"; n'écrivez pas moins de 10 lignes et pas plus de 15 (en français).

3. Répondez en français aux questions suivantes; et faites les réponses aussi complètes que possible:

(a) Qu'est-ce que l'abeille nous donne?

(b) Enumérez les divers articles que l'on fait avec la laine de la brebis.

(c) De quels animaux mangeons-nous la chair? (Donnez au moins 5 exemples).

(d) Avec le poil de quels animaux fait-on les chapeaux?

(e) Comment appelle-t-on les animaux qui vivent dans les bois?

(f) Qu'est-ce qu'on fait avec le lait?

(g) Comment s'appelle la femelle du lièvre?

(h) Comment s'appelle le petit de la jument (Masculin et féminine)

(i) Comment s'appelle le petit de la vache (Masculin et féminine)?

(j) Comment désigne-t-on un homme qui a perdu un oeil, et celui qui a perdu tous les deux?

FRENCH HONORS (French 101-102)

April 22nd, 1915.

1. Translate into English:

Guillaume de Palerne

Endementiers qu'ensi estoient
Et que laiens entrer voloient
Par le commant à la justise
Qui por eus prendre les atise
Et semont forment et efforce.
A tant es vos parmi la roce
Le garoul la goule baee.
Trés parmi outre l'assamblee
Va le fil au prevost aerdre,
Mix velt l'ame de son cors perdre
C'as deus amans secors ne face.
L'enfant travers sa geule en harce;
A tot s'en vait, plus n'i arreste,
Et quant li prevos voit la beste
Qui son petit fil emportoit,
Sa gent escrie a grant esploit;
"Fil a baron, montés, montés,
"Or i parra quel le ferés:
"Voiant vos tos et voiant mi
"En a cis leus mon fil ravi.
"Veés le la, or del secorre."
Dont laissent tuit après lui corre.
Cil a cheval furent monté
Et cil a pié sont arrouté
Après la beste qui s'enfuit.
Nus n'i remaint n'i voisent tuit.
Tuit ont gerpie la quarriere
Por enchaucier la beste fiere
Qui le petit enfant emporte
Qui de paor se desconforte

Et brait et crie mult souvent;
Et neporquant nul mal ne sent
De riens que la beste li face.
Après la beste est grans la chace;
Li leus s'en va auques fuiant,
Et cil le vont après sivant.
Quant d'eus est près, puis les esloigne;
Mult set bien faire sa besoigne.
Et puis vers ceus a pié repaire,
Mais n'i voelent lancier ne traire,
Car l'enfant doutent a blecier.
Ensi por la gent eslongier
Des deus amans le fait la beste:
Sovente fois vers eus s'arreste.

2. Scan lines 4085-4090. Point out any particularities in the rimes or metre.

3. Trace carefully the descent of the following words: -

eus	line 4078	Cheval	line 4097
Tres	" 4082	Nus	" 4100
Mix	" 4084	riens	" 4107
es	" 4080	leus	" 4109
baron	" 4091	Mult	" 4112
tuit	" 4096	deutent	" 4114

4. Describe what seem to you to be the characteristic features of the Epopée Nationale?

5. Account for the appearance of the Arthurian stories in France.

6. Discuss "Guillaume de Dole" from the point of view of the light it throws on the social customs of the time.

FACULTIES OF ARTS AND SCIENCES AND APPLIED SCIENCES

GENERAL GEOLOGY

(Geol. 51 and 52.)

Wednesday, April 14th Afternoon 2.00 to 5.00

Answer any nine questions in which No. 10 must be included by students in Applied Science.

1. State the mineralogical composition of each of the following rocks,—gabbro, aplite, syenite, conglomerate gneiss, peridotite, dacite, rhyolite, monzonite, sodalite, syenite, diabase, arkose. State to which of the three classes each of the above rocks belongs.

2. Give the periods and epochs, where possible, of the Paleozoic era in the stratigraphic column of North America. Give *two* index fossils of each period.

3. (a) Enumerate the geological formations recognized in Alberta.

   (b) State what you know regarding the origin and mode of occurrence of petroleum and natural gas.

4. Give an adequate classification of the rock forming minerals. Enumerate any twenty minerals.

5. (a) Write brief notes on the following formations,—Benton, Niagara, Grenville, Karroo, Mauch Chunk, Paskapoo, Kootenay, Halysites beds, Huronian, Utica.

   (b) Name and distinguish the six systems of mineral crystals. Give examples of each.

6. Define the following,—fault, laccolith, foliation, metamorphism, coal, syncline, hade, mesa, antecedent stream, dune, hooked spit, geographic cycle, cordillera, Stone Age.

7. Give three types of continental and also three types of marine deposits. Distinguish between residual and alluvial deposits.

8. When did the following first appear,—reptiles, mammals, fishes, crustacea, echinoderms, plants, birds? Give *one* example of each.

9. Describe the geological and physiographical features observed on any *one* of the field excursions.

10. On a horizontal surface a coal seam at A has a strike of N 10°W and dips at 30° to the east. The width of the outcrop is 50 feet. Two miles farther east at B the same seam dips at 10° to the west. Find the thickness of the coal seam at A, and the width of the outcrop at B.

Faculty of Arts and Sciences

MINERALOGY AND PETROGRAPHY

(Geol. 53.)

Monday, April 19th. Afternoon, 2.00 to 5.00

1. Name and distinguish the six systems of mineral crystals. Give the number of planes and axes of symmetry in each system.
2. Tabulate the metallic sulphides and the non-metallic carbonates which you have studied. Give the approximate composition of each.
3. How can the following minerals be distinguished,—
   (a) Magnetite, ilmenite, franklinite.
   (b) Orthoclase, plagioclase, nephelite.
   (c) Calcite, gypsum, florite?
4. Describe the Rosiwal method of determining the mineral composition of a rock. How has the chemical composition of a rock been represented graphically?
5. Mention all the rocks containing Nephelite which you have studied. Classify them and show wherein they differ.
6. Write brief notes on:—
   petrographic province, regional metamorphism, contact assimilation, differentiation of rock magmas, order of crystallization of Igneous rocks.
7. Explain the following textures and structures in rocks:—
   ophitic, orbicular, schlieren, porphyritic, aplitic, felsitic, spherulitic, schistose, poikilitic, anhedral, hypidiomorphic, amygdaloidal.
8. (a) Explain the difference between uniaxial and biaxial crystals.
   (b) By what optical properties can a tetragonal crystal be distinguished from one belonging to the orthorhombic system under the polarizing miscroscope?

FACULTY OF ARTS AND SCIENCES

MINERALOGY

(Geol. 54.)

Friday, April 16th. Morning, 9.00 to 12.00

1. Explain briefly the terms,—plane of symmetry, hemimorphic crystal, dimorphous mineral, prism of the first order, dome face, pseudomorph, parametral length.

2. Describe the total symmetry possible in the (a) normal, (b) pyritohedral, and (c) tetrahedral groups of the Isometric system.

3. Give the formula, system, color, hardness, and cleavage (if any) of the following,—corundum, molybdenite, stilbite, siderite, cryolite, galena, calcite, brucite, sphalerite, franklinite.

4. How would you distinguish the following minerals:—

   (a) cinnabar, zincite, turgite and cuprite.

   (b) bornite, pyrrhotite, niccolite, marcasite.

   (c) selenite, Iceland spar, brucite and muscovite?

5. Name any *two* minerals in which each of the following elements occur,—silver, arsenic, cobalt, boron, barium, nickel, gold.

6. Find the percentages of (a) zinc and sulphur in sphalerite (Zn. 65.4; S, 32); (b) copper, iron and sulphur in chalcopyrite (Cu, 63; Fe, 56; S, 32.).

7. Describe, in order, the various tests you would make in the blowpipe determination of each of the following minerals with metallic lustre,—ilmenite, enargite, and zincite.

8. Enumerate and give the formula of the sulphide minerals of each of the following,—copper, zinc, iron, lead, tin, silver.

Faculty of Applied Science

CANADIAN GEOLOGY

(Geol. 54.)

Saturday, March 20th, 1915 9.00 to 11.00 a.m.

1. Describe the physical features of the Cordilleran Region and enumerate the mining districts of importance.
2. Give the subdivisions of the Silurian and Devonian in the Niagara Peninsula and mention the horizons of economic importance.
3. Explain,—Niagara escarpment, Laurentian shield, Third prairie steppe, Manitoba escarpment, Laramide revolution, Rocky Mountain trench.
4. Outline the physical features of the Great Central Plain.
5. Give reasons for or explain the origin and position of the following:—Cypress Hills, Hand Hills, Lake Wabamun Porcupine Hills, Okotoks "Big Rock," Lake Athabasca.
6. Describe Lake Agassiz—its origin and extent.
7. Tabulate, giving locality, any *two* economic deposits of the Maritime provinces, and of each of the other provinces in the Dominion.

FACULTY OF ARTS AND SCIENCES

GERMAN 1

I.

Wednesday, April 21st. Afternoon, 2.00 to 5.00

1. Translate into English:

„Zum Glück—oder, wie man will, zum Unglück—war derzeit ein ganz reputierliches Frauenzimmer in der Stadt, die einst bei einer Schauspielertruppe als Souffleuse gedient hatte und daher in derlei Dingen nicht unbewandert war. Diese—Kröpel-Lieschen nannten sie die Leute von wegen ihrer Kreuzlahmheit—ging sofort auf unser Anerbieten ein, und bald entwickelte sich am Feierabend und an den Sonntagnachmittagen die lebhafteste Tätigkeit in Vater Josephs Stübchen.

Explain this passage with a full account of its context.

2. Translate into English:

Diese war sehr betroffen und bewegt durch das unerwartete Abenteuer; doch fasste sie sich zuerst, und die Lage der Dinge überschauend, beschloss sie, ihr eigenes Schicksal an des Meisters wunderlichen Einfall zu knüpfen, und betrachtete diesen als eine höhere Eingebung; sie holte gerührt ein Schatzkästlein hervor und stach mit einer Nadel zwischen die Blätter, und der Spruch, welchen sie aufschlug, handelte vom unentwegten Verfolgen eines guten Zieles. Sodann liess sie die aufgeregten Gesellen aufschlagen, und alles, was diese aufschlugen, handelte vom eifrigen Wandel auf dem schmalen Wege, vom Vorwärtsgehen ohne Rückschauen, von einer Laufbahn, kurz vom Laufen und Rennen aller Art, so dass der morgende Wettlauf deutlich von Himmel vorgeschrieben schien.

Give a brief summary of the "Wettlauf" and its results.

3. Translate into English (unseen):

Karl und Alkuin.

Kaiser Karl war nicht nur ein gewaltiger Kriegsheld, sondern auch ein eifriger Freund und Förderer der Wissenschaften. Im Frieden arbeitete er fast täglich mit seinem gelehrten Freunde Alkuin zusammen, mit dem er die Werke berühmter Männer der Vorzeit las. Besonders fand er Gefallen an den Schriften der Kirchenväter, namentlich an denen des Hieronymus und Augustin. Die gelehrten Männer, die in seinem weiten Reiche lebten, zog er an seinen Hof, verwandte sie in geeigneten Aemtern und hielt sie hoch in Ehren. Aber ihre Zahl war gering; denn seine Franken fanden mehr Gefallen an Jagd und Krieg, als an Büchern. Deshalb rief er einmal unmutig aus: Hatte ich doch zwölf Giestliche von solchem Wissen, wie es Hieronymus und Augustin besassen!" Da sagte der fromme Alkuin: „Der Herr des Himmels und der Erde hatte nur zwei solcher Männer, und du willst deren zwölf haben!"

II.

1. Translate into German:

(a) This is my room; these are my books.

(b) I cannot promise but I hope to come.

(c) The stranger was long remembered and his story was believed everywhere.

(d) Please close the door when you go.

(e) The little children of Hameln followed the wonderful piper.

(f) He did not lead them into the river but past it into a large cave.

2. Write a composition in German of not less than 50 words on either—

(a) A ballad of Uhland's *or*

(b) Gottfried Keller.

FACULTY OF ARTS AND SCIENCES

GERMAN 2

Monday, April 19th. Afternoon, 2.00 to 5.00

I.

1. Translate into English:

Sie werden fragen: Wozu denn die russischen Truppennaufstellungen in dieser kostspieligen Form? Ja, das sind Fragen, auf die man von einem auswärtigen Kabinett, welches dabei beteiligt ist, nicht leicht eine Aufklärung fordern kann. Wenn man Erklärungen darüber zu fordern anfinge, so könnten sie geschraubt ausfallen, und die Triplik ist auch wiederum geschraubt. Das ist eine gefährliche Bahn, die ich nicht gern betrete. Truppenaufstellungen sind meines Erachtens Erscheinungen, über die man nicht—mit einem Studentenausdruck—„koramiert," kategorische Erklärungen fordert, sondern denen gegenüber man mit derselben Zurückhaltung und Vorsicht seine Gegenmassregeln trifft.

Explain briefly Bismarck's attitude to the question involved above.

2. Translate into English:

Was Eure Majestät durch meine Hand
Verbreiten—ist das Menschenglück?—Ist das
Dasselbe Glück, das meine reine Liebe
Den Menschen gönnt?—Vor diesem Glücke würde
Die Majestät erzittern—Nein! Ein neues
Erschuf der Krone Politik—ein Glück,
Das *sie* noch reich genug ist auszuteilen,
Und in dem Menschenherzen neue Triebe,
Die sich von diesem Glücke stillen lassen.
In ihren Münzen lässt sie Wahrheit schlagen,
Die Wahrheit, die sie dulden kann. Verworfen
Sind alle Stempel, die nicht diesem gleichen.

Discuss the above speech and the occasion of it (1) as a logical development of the plot, (2) as an integral part of the drama.

3. Translate into English (unseen):

Als nun der Aufstand des Mahdi Englands ägyptische Interessen bedrohte, erinnerte man sich dieses selbstlosen Charakters und bedeutenden Offiziers. Gordon erhielt von der englischen Regierung den Befehl, aus den gefährdeten Städten wie Berber und dem noch südlicheren Chartum die Besatzung, die Beamten, Kaufleute und was sonst vom Mahdi bedroht war nach Kairo in Sicherheit zu bringen. Er kam allein, ohne Heer; aber sein Name hatte Kraft. Der Freudentaumel in Chartum war unbeschreiblich: sie küssten dem Retter Gewand, Hände, Füsse (so dass er merhmals im Einzugsgewimmel zu Boden fiel), sie erwarteten alles Heil von diesem Vater der Armen. Doch es war zu spät zum Rückzug nach dem nördlichen Aegypten: das Zwischengelände ward aufständisch, es war kein Durchmarsch mehr möglich. Er selbst hätte sich noch auf einem Nildampfer retten können; auch über Abessinien wäre anfangs vielleicht ein Abzug möglich gewesen, wenn nicht so unsichere Verhaltungsbefehle vom Vertreter der englischen Regierung ausgegangen wären. (Fritz Lienhard).

II.

1. Translate into German:

She was shown into the breakfast parlour, where all but Jane were assembled, and where her appearance created a good deal of surprise. That she should have walked three miles so early in the day, in such dirty weather, and by herself, was almost incredible to Mrs. Hurst and Miss Bingley; and Elizabeth was convinced that they held her in contempt for it. She was received, however, very politely by them; and in their brother's manners there was something better than politeness; there was good-humour and kindness. Mr. Darcy said very little and Mr. Hurst nothing at all. The former

was divided between admiration of the brilliancy which exercise had given to her complexion, and doubt as to the occasion's justifying her coming so far alone. The latter was thinking only of his breakfast. (Jane Austen.)

2. Write a composition in German of not less than 100 words on either—

(a) Das Nest der Zaunkönige; *or*

(b) Schiller's life.

Faculty of Applied Science

GERMAN 41

Tuesday, April 20th.. Morning, 9.00 to 12.00

1. Translate into English:

„Und weil das kleine L. sich dessen bewusst war, wie viel besser er von den übrigen Kadetten behandelt wurde, als sein Bruder, so that ihm das um seinen Bruder leid. Wenn sie auf dem Hofe spazieren gingen, dann konnte man sehen, wie er von Zeit zu Zeit nach dem Bruder ausschaute, ob er auch jemanden hätte, mit dem er ging. Dass er in der Klasse dem Bruder vorsagte und ihn von sich abschreiben liess, wenn Extemporalien diktiert wurden, das versteht sich von selbst; aber er passte auch auf, dass niemand seinen Bruder was zu leide that, und wenn er ihn so manchmal von der Seite ansah, ohne dass der grosse acht darauf gab, dann wurde das Gesichtchen oft ganz merkwürdig ernst, beinahe als ob er sich um den Bruder sorgte——"

2. Translate into English:

Man füllt die Erweiterung und einen Teil der Röhre mit chemisch reinem Quecksilber, indem man durch Erhitzen die in der Erweiterung und Röhre befindliche Luft ausdehnt, hierauf die Röhre mit ihrer Mündung in das chemisch reine Quecksilber stellt; beim Abkuehlen der Erweiterung und der in ihr enthaltenen Luft *zieht* sich letztere zusammen und an die Stelle der verdrängten Luft *tritt* jetzt Quecksilber. Durch mehrmaliges Wiederholen dieses Verfahrens und Erhitzen des Quecksilbers bis zum Sieden wird sowohl die Erweiterung als auch die Thermometerröhre luftleer und füllt sich beim Erkalten ganz mit Quecksilber. Man erwärmt nun das Gefäss etwas über die höchste Temperatur, welche das Thermometer noch anzeigen soll und *schmilzt* sodann die Spitze der Thermometerröhre, solange letztere noch vollständig mit Quecksilber gefüllt ist, zu.

Write out the principal parts and the full present tense of the verbs in italics.

3. Translate into English (unseen):

(a) Die Anziehung zwischen den einzelnen Teilen eines Körpers heisst die Kraft des Zusammenhanges oder die Kohäsion. Nach der Grösse derselben unterscheidet man feste, tropfbarflüssige und luftförmige Körper (Eisen, Wasser, Luft). Feste Körper haben eine starke Kohäsion und daher einen bestimmten Rauminhalt und eine bestimmte Gestalt. Flüssige Körper haben nur geringe Kohäsion und daher einen bestimmten Rauminhalt, aber keine bestimmte Gestalt. Sie nehmen stets die Form ihrer Behälter an und fliessen beim Ausgiessen auseinander. Die Oberfläche einer ruhenden Flüssigkeit bildat eine wagerechte Ebene. Um die wagerechte Richtung einer Ebene zu bestimmen, gebraucht man zu genauen Messungen die Wasserwage oder Libelle. Wird durch einen hineingeworfenen Stein oder durch irgend eine andere Ursache in einer ruhenden Wasserfläche eine Vertiefung hervorgebracht, so bilden sich von diesem Mittelpunkte ringförmig auslaufende Wellen (Wellenberge und Wellentäler) ohne fortschreitende Bewegung der Flüssigkeit.

(b) Jeder Muskel stellt eine fleischige, von Blut rot gefärbte, weiche Masse dar, die aus lauter Bündeln von feinen Muskelfasern besteht. Diese sind durch Bindegewebe zusammengehalten und setzen sich selbst wieder aus Bündeln feinster Muskelfäden zusammen. Der ganze Muskel steckt in einer dünnen, weissen, zähen Haut, der Sehnenbinde (Fascie); die beiden Enden der Fasern laufen in ähnliche, weisse Massen aus, die Sehnen. Diese sind sehr viel fester und zäher als die Muskeln selbst, befestigen sie an den Knochen oder sonstigen Anhe-tungsstellen und dienen der Kraftübertragung von den Muskeln auf die bewegten Teile. Die Masse der Muskelfasern bezeichnet man als Muskelbauch, die beiden Enden, an denen die Sehnen sich finden, als Ursprung

und Ansatz, letzteres so, dass man das Ende, gegen welches die Bewegung in der Regel gerichtet ist, als das ruhende Ende, als Ursprung, das bewegte Ende als Ansatz bezeichnet. Dabei bleibt zu beachten, dass manche Muskeln in doppelter Richtung arbeiten können. So z. B. bewegen die Kiefermuskeln in der Regel den Unterkiefer auf- und abwärts; bei aufgestütztem Kinn können sie aber auch den Kopf heben.

FACULTY OF ARTS AND SCIENCES

GERMAN 52

Saturday, April 17th. Afternoon, 2.00 to 5.00

1. Translate, identify and comment on:

   (a) Und du flickst zwischen der Vergangenheit
   Erhabne Trümmer
   Für deine Bedürfniss'
   Eine Hütte, o Mensch,
   Geniessest über Gräbern!

   (b) Indessen schritt sein Geist gewaltig fort
   Ins Ewige des Wahren, Guten, Schönen,
   Und hinter ihm, in wesenlosem Scheine,
   Lag, was uns alle bändigt, das Gemeine.

   (c) Nur wo du bist, sei alles, immer kindlich,
   So bist du alles, bist unüberwindlich.

   (d) Volk und Knecht und Ueberwinder,
   Sie gestehn zu jeder Zeit:
   Höchstes Glück der Erdenkinder
   Sei nur die Persönlichkeit.

2. Translate into English:

   Von allen Geistern, die verneinen,
   Ist mir der Schalk am wenigsten zur Last.
   Des Menschen Tätigkeit kann allzuleicht erschlaffen,
   Er liebt sich bald die unbedingte Ruh;
   Drum geb'ich gern ihm den Gesellen zu,
   Der reizt und wirkt und muss als Teufel schaffen.

   Relate this conception of Mephistopheles to the central idea of Faust. Can it be regarded as part of Goethe's original plan?

3. By what device does Goethe insert his conception of Hamlet in the story of Wilhelm Meister? State briefly what you know of that conception.

4. Translate into English (unseen):

Ich machte mich ins Freie; die alte Bergstadt, Felsen, Wald, Fluss and See und das formenreiche Gebirge lagen im milden Schein der Märzsonne, und indem meine Blicke alles unfassten, empfand ich ein reines und nachhaltiges Vergnügen, das ich früher nicht gekannt. Es war die hingebende Liebe an alles Gewordene und Bestehende, welche das Recht und die Bedeutung jeglichen Dinges ehrt und den Zusammenhang und die Tiefe der Welt empfindet. Diese Liebe steht höher als das künstlerische Herausstehlen des einzelnen zu eigennützigem Zwecke, welches zuletzt immer zu Kleinlichkeit und Laune führt; sie steht auch höher, als das Geniessen und Absondern nach Stimmungen und romantischen Liebhabereien, und nur sie allein vermag eine gleichmässige und dauernde Glut zu geben. Es kam mir nun alles und immer neu, schön und merkwürdig vor und ich begann, nicht nur die Form, sondern auch den Inhalt, das Wesen und die Geschichte der Dinge zu sehen und zu lieben. Obgleich ich nicht stracks mit einem solchen fix und fertigen Bewusstsein herumlief, so entsprang das nach und nach Erwachende doch durchaus aus jenen vierzig Tagen. (GottfriedKeller, upon a first acquaintance with Goethe's works.)

5. Write a composition in German of not less than 200 words on one of the following themes:

(a) Goethe in Strassburg,

(b) Frau von Stein,

(c) National History in German Literature.

FACULTY OF ARTS AND SCIENCES

GREEK A.

Tuesday, April 20th. Morning, 9.00 to 12.00

1. Give genitive singular and dative plural of ἡγεμών, βασιλεύς, κριτής, πατήρ.

2. Decline in the singular ἡ ἄδικος γυνή and in the plural πᾶσα ἡ πόλις.

3. Give comparative and superlative of μέγας, μάλα, μέσος and ταχύς.

4. Give accusative singular (all genders) of πολύς and ἡδύς and accusative plural (all genders) of ἐνδεής and μέλας.

5. Write out in full:
   (a) The pluperfect indicative passive of πείθω.
   (b) The imperfect indicative active of δίδωμι.
   (c) The present optative active of δηλῶ.
   (d) The aorist imperative middle of ποιῶ.

6. Give the paradigms of:
   (a) The aorist passive of ἀγγέλλω.
   (b) The aorist active of ἵημι.
   (c) The perfect passive of πλέκω.

7. Parse πεπλέχθω, λιποῦ, ἐτετίμησο, ποίει, ἔσῃ.

8. Translate into English:
   (a) Βουκόλος ποτὲ μίαν τῶν βοῶν ἀποῦσαν ἤσθετο καὶ πανταχ ? ἐρευνήσας οὐχ εὗρεν. ηὔξατο οὖν τῷ Διὶ μόσχον θῦσαι, ἐὰν τὸν κλέπτην ἴδῃ.
   (b) Ἀχάριστος εἶ, ὦ φίλη· καλὸν γὰρ μισθὸν ἤδη σοι δέδωκα. ἔχωνἔ γὰρ τὴν κεφαλὴν ἐν τῷ στόματι, εἴασά σε ὅμως ζῶσαν ἀπιέναι.
   Parse ἤσθετο and εἴασα.

9. Translate into Greek:
   (a) The cause of this contest is not clear.
   (b) My father and your mother shall be honoured.
   (c) I will not loose the man who did this.
   (d) The citizens will announce the words of the judge.

Faculty of Arts and Sciences

LYSIAS: HOMER'S ODYSSEY: GREEK PROSE
(Greek 1)

Tuesday, April 20th. Morning, 9.00 to 12.00

1. Translate into English:

Ἤδη δέ τινων ᾐσθόμην, ὦ βουλή, καὶ διὰ ταῦτα ἀχθομένων μοι, ὅτι νεώτερος ὢν ἐπεχείρησα λέγειν ἐν τῷ δήμῳ. ἐγὼ δὲ τὸ μὲν πρῶτον ἠναγκάσθην ὑπὲρ τῶν ἐμαυτοῦ πραγμάτων δημηγορῆσαι, ἔπειτα μέντοι καὶ ἐμαυτῷ δοκῶ φιλοτιμότερον διατεθῆναι τοῦ δέοντος, ἅμα μὲν τῶν προγόνων ἐνθυμούμενος, ὅτι οὐδὲν πέπαυνται τὰ τῆς πόλεως πράττοντες, ἅμα δὲ ὑμᾶς ὁρῶν (τὰ γὰρ ἀληθῆ χρὴ λέγειν) τούτους μόνους ἀξίους νομίζοντας εἶναι. ὥστε ὁρῶν ὑμᾶς ταύτην τὴν γνώμην ἔχοντας τίς οὐκ ἂν ἐπαρθείη πράττειν καὶ λέγειν ὑπὲρ τῆς πόλεως; ἔτι δὲ τί ἂν τοῖς τοιούτοις ἄχθοισθε; οὐ γὰρ τεροι περὶ αὐτῶν κριταί εἰσιν, ἀλλ' ὑμεῖς.

(a) Explain the case of τινων, τοῦ δέοντος.

(b) Locate and give the principal parts of the underlined verbs.

2. Translate into English:

Καὶ περὶ τούτων οὐδένα ἂν ἐποιησάμην λόγον, εἰ μή ᾐσθανόμην αὐτὸν ὡς δημοτικὸν ὄντα πειράσεσθαι παρὰ τὸ δίκαιον σώζεσθαι, καὶ τῆς εὐνοίας τῆς εἰς τὸ πλῆθος τεκμηρίῳ χρησόμενον ὅτι ἔφυγεν. ἐγὼ δὲ καὶ ἑτέρους ἂν ἔχοιμι ἐπιδεῖξαι τῶν συγκαταλυσάντων τὸν δῆμον τοὺς μὲν ἀποθανόντας, τοὺς δὲ φυγόντας τε καὶ οὐ μετασχόντας τῆς πολιτείας, ὥστε οὐδένα εἰκὸς αὐτῷ τούτου ὑπόλογον γενέσθαι. τοῦ μὲν γὰρ ὑμᾶς φυγεῖν μέρος τι καὶ οὗτος συνεβάλετο, τοῦ δὲ τοῦτον κατελθεῖν τὸ πλῆθος τὸ ὑμέτερον αἴτιον ἐγένετο. ἔτι δὲ καὶ δεινόν, εἰ ὧν μὲν ἄκων ἔπαθε χάριν αὐτῷ εἴσεσθε, ὧν δ' ἑκὼν ἐξήμαρτε μήδεμίαν τιμωρίαν ποιήσεσθε.

(a) Explain the syntax of the underlined words:

3. Translate into English at sight:

Ἐπειδὴ γὰρ αἱ νῆες αἱ ὑμέτεραι διεφθάρησαν καὶ τὰ πράγματα ἐν τῇ πόλει ἀσθενέστερα ἐγεγένητο, οὐ πολλῷ χρόνῳ ὕστερον αἵ τε νῆες αἱ Λακεδαιμονίων ἐπὶ τὸν Πειραιᾶ ἀφικνοῦνται, καὶ ἅμα λόγοι πρὸς Λακεδαιμονίους περὶ τῆς εἰρήνης ἐγίγνοντο. ἐν δὲ τῷ χρόνῳ τούτῳ οἱ βουλόμενοι νεώτερα

πράγματα ἐν τῇ πόλει γίγνεσθαι ἐπεβούλευον, νομίζοντες κάλλιστον καιρὸν εἰληφέναι καὶ μάλιστα ἐν τῷ τότε χρόνῳ τὰ πράγματα. ὡς αὐτοὶ ἐβούλοντο, καταστήσεσθαι. ἡγοῦντο δὲ οὐδὲν ἄλλο σφίσιν ἐμποδὼν εἶναι ἢ τοὺς τοῦ δήμου προεστηκότας καὶ τοὺς στρατηγοῦντας καὶ ταξιαρχοῦντας.

4. Translate into English:

τῆς ἦ τοι φωνὴ μὲν ὅση σκύλακος νεογιλῆς,
γίγνεται, αὐτὴ δ' αὖτε πέλωρ κακόν· οὐδέ κέ τίς μιν
γηθήσειεν ἰδών, οὐδ' εἰ θεὸς ἀντιάσειε.
τῆς ἦ τοι πόδες εἰσὶ δυώδεκα πάντες ἄωροι,
ἓξ δέ τέ οἱ δειραὶ περιμήκεες, ἐν δὲ ἑκάστῃ
σμερδαλέη κεφαλή, ἐν δὲ τρίστοιχοι ὀδόντες,
πυκνοὶ καὶ θαμέες, πλεῖοι μέλανος θανάτοιο.
μέσσῃ μέν τε κατὰ σπείους κοίλοιο δέδυκεν,
ἔξω δ' ἐξίσχει κεφαλὰς δεινοῖο βερέθρου,
αὐτοῦ δ' ἰχθυάᾳ, σκόπελον περιμαιμώωσα,
δελφῖνάς τε κύνας τε καὶ εἴ ποθι μεῖζον ἕλῃσι
κῆτος, ἅ μυρία βόσκει ἀγάστονος Ἀμφιτρίτη.

a) Locate and explain the underlined words.

5. Translate into English:

Κέκλυτέ μευ μύθων, κακά περ πάσχοντες ἑταῖροι·
πάντες μὲν στυγεροὶ θάνατοι δειλοῖσι βροτοῖσι,
λιμῷ δ' οἰκτιστον θανέειν καὶ πότμον ἐπισπεῖν.
ἀλλ' ἄγετ', Ἠελίοιο βοῶν ἐλάσαντες ἀρίστας
ῥέξομεν ἀθανάτοισι, τοὶ οὐρανὸν εὐρὺν ἔχουσιν.
εἰ δέ κεν εἰς Ἰθάκην ἀφικοίμεθα, πατρίδα γαῖαν,
αἶψά κεν Ἠελίῳ Ὑπερίονι πίονα νηὸν
τεύξομεν, ἐν δέ κε θεῖμεν ἀγάλματα πολλὰ καὶ ἐσθλά·
εἰ δὲ χολωσάμενός τι βοῶν ὠρθοκραιράων
νῆ' ἐθέλῃ ὀλέσαι, ἐπὶ δ' ἕσπωνται θεοὶ ἄλλοι,
βούλομ' ἅπαξ πρὸς κῦμα χανὼν ἀπὸ θυμὸν ὀλέσσαι
ἢ δηθὰ στρεύγεσθαι ἐὼν ἐν νήσῳ ἐρήμῃ.'

(a) Write notes on the following Homeric forms, giving the Attic equivalents:

μευ, τοι, ἐών, ῥέξομεν, δειλοῖσι.

(b) What is the relation of this passage to the plot of Odyssey?

(c) Scan the last two lines of the selection.

6. Translate into Greek:
   (a) Nobody could tell me which way to go.
   (b) I told him I would wait at the door till I saw him.
   (c) He would have told you if he had known that you were faithful.
   (d) I am afraid that you are not well.

FACULTY OF ARTS AND SCIENCES

PLATO: EURIPIDES: COMPOSITION AND SIGHT TRANSLATION
(Greek 2)

Tuesday, April 20th. Morning, 9.00 to 12.00

1. Translate into English:

ΣΩ. Οὐκ ἄρα, ὦ βέλτιστε, πάνυ ἡμῖν οὕτω φροντιστέον, τί ἐροῦσιν οἱ πολλοὶ ἡμᾶς, ἀλλ' ὅ,τι ὁ ἐπαΐων περὶ τῶν δικαίων καὶ ἀδίκων, ὁ εἷς, καὶ αὐτὴ ἡ ἀλήθεια. ὥστε πρῶτον μὲν ταύτῃ οὐκ ὀρθῶς εἰσηγεῖ εἰσηγούμενος τῆς τῶν πολλῶν δόξης δεῖν ἡμᾶς φροντίζειν περὶ τῶν δικαίων καὶ καλῶν καὶ τῶν ἐναντίων. ἀλλὰ μὲν δή, φαίη γ' ἄν τις, οἵοί τ' εἰσὶν ἡμᾶς οἱ πολλοὶ ἀποκτιννύναι;

ΚΡ. Δῆλα δὴ καὶ ταῦτα· φαίη γὰρ ἄν, ὦ Σώκρατες.

ΣΩ. Ἀληθῆ λέγεις. ἀλλ', ὦ θαυμάσιε, οὗτός τε ὁ λόγος, ὃν διεληλύθαμεν, ἔμοιγε δοκεῖ ἔτι ὅμοιος εἶναι τῷ καὶ πρότερον· καὶ τόνδε αὖ σκόπει, εἰ ἔτι μένει ἡμῖν ἢ οὔ, ὅτι οὐ τὸ ζῆν περὶ πλείστου ποιητέον, ἀλλὰ τὸ εὖ ζῆν.

2. Translate into English:

σοφῇ δὲ χειρὶ τεκτόνων δέμας τὸ σὸν
εἰκασθὲν ἐν λέκτροισιν ἐκταθήσεται,
ᾧ προσπεσοῦμαι καὶ περιπτύσσων χέρας
ὄνομα καλῶν σὸν τὴν φίλην ἐν ἀγκάλαις
δόξω γυναῖκα καίπερ οὐκ ἔχων ἔχειν,
ψυχρὰν μέν, οἶμαι, τέρψιν, ἀλλ' ὅμως βάρος
ψυχῆς ἀπαντλοίην ἄν· ἐν δ' ὀνείρασι
φοιτῶσά μ' εὐφραίνοις ἄν· ἡδὺ γὰρ φίλους
κἂν νυκτὶ λεύσσειν, ὅντιν' ἂν παρῇ τρόπον.
εἰ δ' Ὀρφέως μοι γλῶσσα καὶ μέλος παρῆν,
ὥστ' ἢ κόρην Δήμητρος ἢ κείνης πόσιν
ὕμνοισι κηλήσαντά σ' ἐξ Ἅιδου λαβεῖν,
κατῆλθον ἄν, καί μ' οὔθ' ὁ Πλούτωνος κύων
οὔθ' οὐπὶ κώπῃ ψυχοπομπὸς ἂν γέρων
ἔσχεν, πρὶν ἐς φῶς σὸν καταστῆσαι βίον.
ἀλλ' οὖν ἐκεῖσε προσδόκα μ', ὅταν θάνω,
καὶ δῶμ' ἑτοίμαζ', ὡς συνοικήσουσά μοι.

ἐν ταῖσιν αὐταῖς γάρ μ' ἐπισκήψω κέδροις
σοὶ τούσδε θεῖναι πλευρά τ' ἐκτεῖναι πέλας
πλευροῖσι τοῖς σοῖς· μηδὲ γὰρ θανών ποτε
σοῦ χωρὶς εἶην τῆς μόνης πιστῆς ἐμοί.

Discuss the indicatives κατῆλθον ἄν and ἔσχεν ἄν.

3. Translate into English:

ΧΟ. ὦ Πελίου θύγατερ,
χαίρουσά μοι εἶν 'Αίδα δόμοισιν
τὸν ἀνάλιον οἶκον οἰκετεύοις.
ἴστω δ' 'Αίδας ὁ μελαγχαίτας θεὸς ὅς τ' ἐπὶ κώπᾳ
πηδαλίῳ τε γέρων
νεκροπομπὸς ἵζει,
πολὺ δὴ πολὺ δὴ γυναῖκ' ἀρίσταν
λίμναν 'Αχεροντίαν πορεύσας ἐλάτᾳ δικώπῳ.
πολλά σε μουσοπόλοι
μέλψουσι καθ' ἑπτάτονόν τ' ὀρείαν
χέλυν ἔν τ' ἀλύροις κλέοντες ὕμνοις,
Σπάρτᾳ κύκλος ἀνίκα Καρνείου περινίσσεται ὥρας
μηνός, ἀειρομένας
παννύχου σελάνας,
λιπαραῖσί τ' ἐν ὀλβίαις 'Αθάναις.
τοίαν ἔλιπες θανοῦσα μολπὰν μελέων ἀοιδοῖς.

4. Translate into English:

τοιγὰρ φυτεύων παῖδας οὐκέτ' ἂν φθάνοις,
οἳ γηροβοσκήσουσι καὶ θανόντα σε
περιστελοῦσι καὶ προθήσονται νεκρόν.
οὐ γάρ σ' ἔγωγε τῇδ' ἐμῇ θάψω χερί.
τέθνηκα γὰρ δὴ τοὐπὶ σ'· εἰ δ' ἄλλου τυχὼν
σωτῆρος αὐγὰς εἰσορῶ, κείνου λέγω
καὶ παῖδά μ' εἶναι καὶ φίλον γηροτρόφον.
μάτην ἄρ' οἱ γέροντες εὔχονται θανεῖν,
γῆρας ψέγοντες καὶ μακρὸν χρόνον βίου·
ἦν δ' ἐγγὺς ἔλθῃ θάνατος, οὐδεὶς βούλεται
θνῄσκειν, τὸ γῆρας δ' οὐκέτ' ἔστ' αὐτοῖς βαρύ.

Comment on construction of καὶ παῖδά μ' εἶναι, καὶ φίλον γηροτρόφον.

5. Translate into English:

XENOPHON ON SOCRATES

Καὶ ὅτε οἱ τριάκοντα προσέταττον αὐτῷ παρὰ τοὺς νόμους τι, οὐκ ἐπείθετο· προσταξάντων γὰρ αὐτῶν ἐκείνῳ τε καὶ ἄλλοις τισὶ τῶν πολιτῶν ἀγαγεῖν τινα ἐπὶ θανάτῳ, μόνος οὐκ ἐπείσθη, διὰ τὸ παρὰ τοὺς νόμους αὐτῷ προστάττεσθαι· καὶ ὅτε τὴν ὑπὸ Μελήτου γραφὴν ἔφευγε, τῶν ἄλλων εἰωθοτων ἐν τοῖς δικαστηρίοις πρὸς χάριν τε τοῖς δικασταῖς διαλέγεσθαι καὶ κολακεύειν καὶ δεῖσθαι παρὰ τοὺς νόμους, ἐκεῖνος οὐδὲν ἠθέλησε τῶν εἰωθότων ἐν τῷ δικαστηρίῳ παρὰ τοὺς νόμους ποιῆσαι, ἀλλὰ ῥᾳδίως ἂν ἀφεθεὶς ὑπὸ τῶν δικαστῶν, εἰ καὶ μετρίως τι τούτων ἐποίησε, προσείλετο μᾶλλον τοῖς νόμοις ἐμμένων ἀποθανεῖν ἢ παρανομῶν ζῆν.

ἀφεθείς: aorist passive participle ἀφίημι.

6. Translate into Greek:

Among the many strange stories which Homer writes in his poems, nothing can seem stranger to us than what is told us concerning the Gods. The anger of Achilles and the injustice of Agamemnon we can readily understand (συνίημι): for these are men, and but act like men. But the Gods often seem more savage than mankind in the poems of Homer: for no man would have treated his wife as Zeus (did) Hera. Moreover the Gods, though they could sometimes give strength to the heroes whom they especially favored, were not always themselves able to withstand certain heroes.

Faculty of Arts and Sciences

AESCHYLUS AND SOPHOCLES
(Greek 51)

Saturday, April 10th. Morning, 9 to 12

1. Translate into English:

   Aeschylus, Agamemnon, 403—426.

   (a) Discuss the text of 412-13 πάρεστι....ἰδεῖν, and of 420.

   (b) Discuss the interpretation of εὖτ' ἂν....ὁρᾷ (MS. ὁρᾶν).

2. Translate into English:

   Aeschylus, Agamemnon, 661-679.

   (a) Discuss Wecklein's ἅρμῳ for ὅρμῳ in 665.
   (b) Comment on μολεῖν and discuss suggested variants.

3. Translate into English:

   Aeschylus, Agamemnon, 886-901.

   Discuss Verrall's theory of the time-unity of the Agamemnon.

4. Translate into English:

   Aeschylus, Agamemnon, 1167-1177.

   Indicate in the margin the readings which you adopt.

5. Translate into English:

   Sophocles, Antigone, 175-190.

   Discuss briefly Sophocles' treatment of Creon's character.

6. Translate into English:

   Sophocles, Antigone, 332-352.

7. Translate into English:

   Sophocles, Antigone, 661-678.

   Write a brief note on the optative στήσειε.

8. Translate into English:

Sophocles, Antigone, 781-799.

Comment on and illustrate, if possible, the syntax of *καί σ' οὔτ' ἀθανάτων φύξιμος οὐδείς.*

9. Translate at sight:

Ἀρχίδαμε καὶ Λακεδαιμόνιοι, οὐ δίκαια ποιεῖτε οὐδ' ἄξια οὔτε ὑμῶν οὔτε πατέρων ὧν ἐστέ, ἐς γῆν τὴν Πλαταιῶν στρατεύοντες. Παυσανίας γὰρ ὁ Κλεομβρότου Λακεδαιμόνιος ἐλευθερώσας τὴν Ἑλλάδα ἀπὸ τῶν Μήδων μετὰ Ἑλλήνων τῶν ἐθελησάντων ξυνάρασθαι τὸν κίνδυνον τῆς μάχης ἦ παρ' ἡμῖν ἐγένετο, θύσας ἐν τῇ Πλαταιῶν ἀγορᾷ ἱερὰ Διὶ ἐλευθερίῳ καὶ ξυγκαλέσας πάντας τοὺς ξυμμάχους ἀπεδίδου Πλαταιεῦσι γῆν καὶ πόλιν τὴν σφετέραν ἔχοντας αὐτονόμους οἰκεῖν, στρατεῦσαί τε μηδένα ποτὲ ἀδίκως ἐπ' αὐτοὺς μηδ' ἐπὶ δουλείᾳ· εἰ δὲ μή, ἀμύνειν τοὺς παρόντας ξυμμάχους κατὰ δύναμιν. τάδε μὲν ἡμῖν πατέρες οἱ ὑμέτεροι ἔδοσαν ἀρετῆς ἕνεκα καὶ προθυμίας τῆς ἐν ἐκείνοις τοῖς κινδύνοις γενομένης, ὑμεῖς δὲ τἀναντία δρᾶτε· μετὰ γὰρ Θηβαίων τῶν ἡμῖν ἐχθίστων ἐπὶ δουλείᾳ τῇ ἡμετέρᾳ ἥκετε. μάρτυρας δὲ θεοὺς τούς τε ὁρκίους τότε γενομένους ποιούμενοι καὶ τοὺς ὑμετέρους πατρῴους καὶ ἡμετέρους ἐγχωρίους, λέγομεν ὑμῖν γῆν τὴν Πλαταιΐδα μὴ ἀδικεῖν μηδὲ παραβαίνειν τοὺς ὅρκους, ἐὰν δὲ οἰκεῖν αὐτονόμους καθάπερ Παυσανίας ἐδικαίωσεν.

FACULTY OF ARTS AND SCIENCES

PLATO: THE REPUBLIC

(Greek 101a)

Saturday, April 24th — Morning, 9.00 to 12.00

1. Translate: Republic 441 D—442 B.
   (Μηημονευτέον ἄρα..... πάντων ἀνατρέψῃ).

   (a) το αὐτοῦ... πράττειν. Trace the development of this principle in the argument of the *Republic*.

   (b) ὃ δὴ πλεῖστον.. ἀνατρέψῃ. Where is this condition of the soul described more fully? What is the political counterpart?

   (c) ξύμφωνα αὐτὰ ποιήσει. What method of harmonizing these elements is proposed in the *Politicus*?

   (d) τῶν περὶ τὸ σῶμα.... ἡδονῶν. Explain by reference to *Republic IX*.

2. Translate: Republic 504D—505B.
   (Τὴν μακροτέραν.... Μὰ Δί', οὐκ ἔγωγ', ἔφη).

   (a) τὴν μακροτέραν. What indications has Plato given of this method? Compare it with the method used by him in the definition of the virtues.

   (b) ὑπογραφὴν ὥσπερ νῦν. Explain.

   (c) ἐπεὶ ὅτι γε ἡ τοῦ ἀγαθοῦ ἰδέα μέγιστον μάθημα. What is the relation of the μέγιστον μάθημα to the propaedeutic studies in subject matter and method?

3. Translate at sight:
   Plato, *Gorgias*, 464 B—C.
   (Φέρε δή σοι..... πλείστου ἄξια εἶναι).

   (a) Interpret this passage in relation to the allegory of the cave.

4. Translate at sight :

Plato, *Politicus*, 302 E—303 A.

(**Μοναρχία τοίνυν.... τῶν ἄλλων πολιτειῶν**)

(a) Compare with the classification of constitutions and the principle of classification in the *Republic* and in Aristotle's *Politics*.

5. *ἴσως γὰρ οὐκ οἶσθα ὅτι μόγις μοι τὼ δύο κύματε ἐκφυγόντι νῦν τὸ μέγιστον καὶ χαλεπώτατον τῆς τρικυμίας ἐπάγεις.*

Explain *τὼ δύο κύματε* and *τὸ μέγιστον.... τῆς τρικυμίας*.

6. *καὶ περὶ δικαίου καὶ ἀδίκου καὶ ἀγαθοῦ καὶ κακοῦ καὶ πάντων τῶν εἰδῶν πέρι ὁ αὐτὸς λόγος, αὐτὸ μὲν ἓν ἕκαστον εἶναι, τῇ δὲ τῶν πράξεων καὶ σωμάτων καὶ ἀλλήλων κοινωνίᾳ πανταχοῦ φανταζόμενα πολλὰ φαίνεσθαι ἕκαστον.*

Interpret.

FACULTY OF ARTS AND SCIENCES

ADVANCED GREEK SYNTAX
(Greek 101b)

Saturday, April 24th. Afternoon, 2.00 to 4.00

1. δέδοιχ' ὅπως μὴ ἀνάγκη γένηται (γενήσεται v. l.)

   What two constructions are combined here? Explain the origin of each, the several steps in their development, and the cause of their fusion.

2. Trace briefly the extension of the use of the infinitive from its original forçe.

3. Give two theories in regard to the origin of the οὐ μή construction with the subjunctive and the future indicative.

4. Locate and explain the syntax of the words underlined in the following sentences:

   (a) Ἐμὲ εἰ μὲν ἐν ἄλλαις τωὶν ἡμέραις ἠδίκησέ τι τούτων ἰδιώτην ὄντα, ἰδίᾳ καὶ δίκην προσῆκεν αὐτῷ διδόναι.

   (b) Εἰ μέν τις τὸν ὄνειρον Ἀχαιῶν ἄλλος ἐνισπε, ψεῦδός κεν φαῖμεν καὶ νοσφιζοίμεθα μᾶλλον.

   (c) ...Τἄλλ' ἐγὼ καπνοῦ σκιᾶς
   οὐκ ἂν πριαίμην ἀνδρὶ πρὸς τὴν ἡδονήν.

   (d) Σὺ δὲ
   κέλευθον ἥνπερ ἦλθες ἐγκόνει πάλιν.

   (e) Καί σ' οὔτ' ἀθανάτων φύξιμος οὐδείς.

   (f) Ἀτεχνῶς οὖν ξένως ἔχω τῆς ἐνθάδε λέξεως.

   (g) Εἰωθὼς λούεσθαι εὐρρεῖος ποταμοῖο.

   (h) Θαυμάζω δὲ τῇ τε ἀποκλῄσει μου τῶν πυλῶν καὶ εἰ μὴ ἀσμένοις ὑμῖν ἀφῖγμαι.

   (i) Κεῖσαι σᾶς ἀλόχου σφαγείς.

   (j) Τὸ γὰρ σὸν ὄμμα δεινὸν ἀνδρὶ δημότῃ λόγοις τοιούτοις.

   (k) Τῆς θυμοβόρου φρένα λύπης.

   (l) Ὦ γέρον, οὔ τι ψεῦδος ἐμὰς ἄτας κατέλεξας.

(m) Ὑμῖν δὲ τοιοῦτον οὔτ' ἦν μήτε γένοιτο τοῦ λοιποῦ.

(n) Οὐκ εἶ σύ τ' οἶκους, σύ τε, Κρέον, κατὰ στέγας,
καὶ μὴ τὸ μηδὲν ἄλγος εἰς μέγ' οἴσετε;

(o) Οὐ γὰρ ἂν μακράν ἴχνευον αὐτος, μὴ οὐκ ἔχων τι σύμβολον.

(p) Ἐχρῆν αὐτοὺς τὴν προτέραν ζήτησιν ζητεῖν,
ἵνα ἀπηλλάγμεθα τούτου τοῦ κινδύνου.

(q) Ἐξώλης ἀπολοίμην καὶ προώλης, εἰ προσλαβών γ' ἂν ἀργυρίον
πάνυ πολὺ μετὰ τούτων ἐπρέσβευσα.

(r) Τῷ οὐκ ἂν βασιλῆας ἀνὰ στόμ' ἔχων ἀγορεύοις.

(s) Πείσομαι γὰρ οὐ
τοσοῦτον οὐδὲν ὥστε μὴ οὐ καλῶς θανεῖν.

(t) Βούλει τὸ πρᾶγμα τοῖς θεαταῖσιν φράσω;

(u) Ἔφευγον ἔνθα μήποτ' ὀψοίμην κακῶν
χρησμῶν ὀνείδη τῶν ἐμῶν τελούμενα.

(v) Καὶ ποτέ τις εἴπῃσι καὶ ὀφιγόνων ἀνθρώπων.

(w) Ταῦτ' εἴποις Ἀχιλῆϊ δαίφρονι εἴ κε πίθηται.

(x) Ἦ μέν σ' ἐνδυκέως ἀπεπέμπομεν ὄφρ' ἂν ἵκηαι.

(y) Ἀλλ' ἐρέω μὲν ἐγὼν, ἵνα εἰδότες ἦ κε θάνωμεν
ἦ κεν ἀλευάμενοι θάνατον καὶ κῆρα φύγοιμεν.

(z) Ὄλοιο μήπω, πρὶν μάθοιμ' εἰ καὶ πάλιν γνὼμην μετοίσεις.

Faculty of Medicine.

GROSS ANATOMY.

Saturday, April 17th. Morning, 9.00 to 12.00

Answer any four questions.

1. Describe the diaphragm of the thorax.
2. Describe the sensory nerve-supply of the hand, following the nerves to the spinal cord.
3. Describe the sciatic nerve, *nervus ischiadicus*, under the headings:
   (a) origin,
   (b) course,
   (c) distribution.
4. Describe the kidney under the headings:
   (a) form and size,
   (b) blood vessels,
   (c) gross structure,
   (d) situation and relations.
5. Describe the inferior vena cava.

FACULTY OF ARTS AND SCIENCES

HEBREW 51

Thursday, April 15th. Afternoon, 2.00 to 5.00

1. Translate literally Genesis 1:6—10, carefully placing all verb forms; comment upon any idioms in these verses.

2. Translate carefully Genesis II:10-22; place all Piel and Hiphil forms and all *Infinities*.

3. Translate Genesis III:8—18, and explain all verb forms other than Qals.

4. Mention the principal classes of noun formation; explain fully the Segholate noun, and give a synopsis of one in each class.

5. (a) Give the general rule for accent and the effect of the shifting of accent, (b) distinguish between Daghesh-lene and Daghesh-forte; (c) explain sharpened, closed, half-open and open syllables, and tone-long and naturally long vowels; (d) distinguish between strong and weak verbs and mention all the classes of the latter.

6. Translate careful into Hebrew:
   (a) He will give the good light and the evil darkness.
   (b) God made men in the sixth day and He rested in the seventh day.
   (c) The woman will eat the fruit and of it she will give to her husband who will eat with her.
   (d) The sun is larger than the moon.
   (e) Any one killing me shall die.

Faculty of Medicine

HISTOLOGY & SPLANCHNOLOGY

Wednesday, April 21st. Afternoon, 2.00 to 5.00

Answer any four questions.

1. Describe the lobule of the liver, including its bile-passages and blood channels.
2. Describe the minute structure of the skin.
3. Describe the minute structure of living bone.
4. Describe the tunica mucosa of the small intestine. How does it differ from that of the colon?
5. Describe the lobule of the lung.

FACULTY OF ARTS AND SCIENCES

HISTORY I

Saturday, April 17th. Morning, 9.00 to 12.00

1. Outline briefly the rights obtained under the Great Charter of 1215.
2. Discuss the position of the British Parliament under the Tudor monarchs.
3. State briefly the chief constitutional liberties secured by the Bill of Rights of 1688.
4. State the chief arguments advanced for and against the Corn Laws.
5. Briefly outline the position of the Crown in the British constitutional system.

Faculty of Arts and Sciences

INTRODUCTION TO GENERAL HISTORY

(Hist. 2)

Friday, April 16th. Morning, 9.00 to 12.00

1. "Crete was the forerunner of Greece." Discuss.
2. Outline the causes and trace the course of the Peloponnesian war.
3. "The degeneracy of Rome began with her dominion." Discuss.
4. Give an account of the establishment of the Carolingian Empire. Why did it break down?
5. Trace the history of the Papacy in the fourteenth and fifteenth centuries.
6. Outline and contrast the political thought of Machiavelli and Sir Thomas More.
7. What influence did Metternich have upon the history of Europe?
8. Trace the movement for the unification of Germany.

FACULTY OF ARTS AND SCIENCES

EUROPEAN HISTORY (1453-1598)

(Hist. 54)

Thursday, April 15th. - Morning, 9.00 to 12.00

1. Discuss Machiavelli's views pointing out (a) how far he reflected contemporary history, and (b) to what an extent he is a political thinker of all time.
2. To what extent may we trace the German Reformation to the previous (i) social, (ii) political and (iii) religious condition of Germany.
3. With the aid of a map trace the course of the Hapsburg-Valois struggle from the election of Charles to the Peace of Cambray. What relation does this period of the struggle bear to the rest of the struggle?
4. "The Genevan Reformation was the product of two factors, Geneva and Calvin." Discuss.
5. It has been said that the English Reformation differs from the Reformation on the Continent in being a political movement. How far is this true?
6. "The last (eight) years of William's life were years of almost hopeless struggle to keep united the frail fabric of the seventeen Provinces of the Netherlands in presence of a mighty and relentless foe" (Harrison). Trace this struggle from the Pacification of Ghent and show how it was hopeless.

Faculty of Arts and Sciences

GENERAL HISTORY FROM 1815

(Hist. 56.)

Thursday, April 22nd. Afternoon, 2.00 to 5.00

1. How far has the ideal of a Concert of Europe inaugurated at Vienna in 1815 proved practicable and successful?
2. Discuss the influence of the following factors in French history in the XIX Century: (a) The Republican tradition, (b) the Napoleonic administrative system, (c) the Napoleonic legend.
3. Discuss the Unification of Germany under the following heads:
   (a) the social and economic background,
   (b) its idealistic background,
   (c) the political means by which it was obtained.
4. Discuss the parts played respectively by the following groups in the achievement of Italian Unity:
   (a) the *Young Italy Society.*
   (b) the *Carbonari,*
   (c) the *National Society.*
5. (a(Describe the parts played by England and Bulgaria respectively in the solution of the Eastern question.
   (b) Outline the causes which led to the summoning of the Congress of Berlin in 1878, and the settlement arrived at there. Illustrate your answer with a sketch map.
6. (a) What do you consider the chief landmarks in the growth of political and social liberty in England in the XIX century?
   (b) Compare Gladstone and Beaconsfield as political leaders.

FACULTY OF ARTS AND SCIENCES

ENGLISH CONSTITUTIONAL HISTORY

(Hist. 57)

Friday, April 23rd. Afternoon, 2.00 to 5.00.

1. Discuss the following statements:

   (a) "It (the British Constitution) is the most flexible polity in existence, and is therefore utterly different in character from the rigid constitutions the whole or some part of which can be changed only by some extraordinary method of legislation."

   (b) "The Common law courts have constantly hampered the action of the executive, and by issuing the writ of *habeas corpus* as well as by other means do in fact exert a strict supervision over the proceedings of the crown and its servants."

2. Give an outline of the statutes by which the frequency and duration of parliament have been regulated from 1330 to the present day.

3. Describe and discuss the legal duties and political functions of justices of the peace in England, (a) in the sixteenth, (b) in the eighteenth century.

4. (a) Trace the history of the English county franchise before 1884.

   (b) Describe the provisions and discuss the effect of the *Representation of the People Act* of 1884.

   (c) Outline the steps by which Parliament gained its present control over taxation.

5. Sketch the history of the offices held by the following: the *sheriffs*, the *Chancellor*, the *Bishop of Durham*, the *Lord Privy Seal*, the *President of the Board of Trade*.

6. Discuss the sense in which the following phrases are used by Maitland: *barony, the sovereignty of the law, government by statute, the legal powers of a cabinet meeting, public law.*

Faculty of Arts and Sciences

CANADIAN POLITICAL AND CONSTITUTIONAL HISTORY.

(Hist. 58.)

Saturday, April 17th. Afternoon, 2.00 to 5.00

1. Give an outline (a) of the administration of justice under the French Regime in Canada, (b) of Masères' analysis of the legal problems of Canada at the time of the Quebec Act, (c) of the arrangements provided for the administration of justice by the British North America Act of 1867.

2. Analyze the Constitutional Act of 1791 with reference to the following subjects:

   (a) contemporary views of the British Constitution;

   (b) its provisions for the administration of crown lands;

   (c) the extent to which it reflects the Canadian political situation at the time.

3. (a) Describe the work of Lord Durham and his party.

   (b) Discuss Durham's analysis of the race problem, the political problem and the problem of immigration.

4. Describe the chief political problems which arose out of the Union of 1840, and discuss the solutions proposed by George Brown, John Sandfield Macdonald, and Sir Alexander Galt, respectively.

5. (a) To what extent has the Dominion government control over provincial legislation?

   (b) In what matters have the Dominion and Provincial governments concurrent jurisdiction?

   (c) Compare the Canadian and Australian Federations with regard to Federal control over provincial legislation, and concurrent jurisdiction.

6. Comment on the following statements:

(a) "We represent that as the Grand Jury must be considered at present as the only body representative of the colony, they, as British subjects, have a right to be consulted before any ordinance . . . be passed into law . . ." (Presentment of the Grand Jury of Quebec, 1764.)

6. (b) "The provision that the initiative of all money votes is confined to the governor, is a most valuable and important change in the constitution of these provinces, but it places a responsibility on the executive which can only be exercised under a system which relieves the public funds from demands for every little paltry expenditure . . ." (Sydenham to Russell.)

(c) "I doubt if in the intricate management of a party Wm. Pitt had to contend with difficulties equal to those that Sir John Macdonald had to contend with." (Sir Wilfrid Laurier.)

(d) "Lord Alverstone is therefore entitled to a much more lenient judgment than he has generally received." (James White.)

Faculty of Arts and Sciences.

LATIN A.

Tuesday, April 13th. Morning, 9.00 to 12.00

1. Translate:

Nunc ad aetatem multo antiquiorem oculos vertamus: Romanum orbem relinquamus; de Athenis, maxima Graecarum urbium, et de quinto ante Christum natum saeculo aliquid vos scire debetis. Ecquid unquam audistis de Themistocle Atheniensi? Aliquando discetis qua magnitudine consilii atque ingenii fuerit quantumque pro patria sua fecerit inter magna pericula. Olim ad eum doctus quidam homo accessisse dicitur eumque rogavisse num artem memoriae discere optaret. A quo Themistocles quaesivit (from quaerere) quidnam (from quisnam) illa ars effectura esset. Cui respondit doctor ille se docere quo modo homines omnia meminisse possent. Tum Themistocles, "At si," inquit, "docere potes qua arte in oblivionem certarum rerum venire possimus, multo mihi maius beneficium dabis. Num hanc etiam artem doces?" Sed alter quod responderet non habuit. Ex hac fabula divinare potestis Themistoclem multa fecisse vel vidisse quorum oblivio melior erat quam memoria.

(a) Explain the mood of relinquamus and write out a synopsis of the subjunctive of this verb active and passive in 2nd pers. sing.

(b) vidisse. Give the other tenses of the infinitive, and the participles of this verb.

(c) possent. Give the present and imperfect tenses of this verb, indicative and subjunctive. What is the reason for the mood here?

(d) fecerit. Give reason for mood, and write a synopsis in 3rd plural of the perfect tenses of this verb, active and passive.

(e) Write the principal parts of the following verbs: vertamus, debetis, fuerit, accessisse, dicitur, quaesivit, docere, meminisse, venire, dabis.

2. Decline the Latin equivalents for:—the other day (gen. & dat. & abl. sing.); a deeper harbor (plur.); that race (sing.); all work (plur.); what journey (sing.)?

3. Locate and give the other terms of comparison of the following: melius, minime, magno opere, facilius, acriter.

4. Locate the following verb forms: loqui, patere, oriretur, adipisceris, fac, voltis, moriturus, fungamur.

5. Translate into Latin:

(a) Did you suppose that so few ships would carry all the soldiers?

(b) One keeps silent about these matters.

(c) Let us be friends always.

(d) They have sent some envoys to discuss terms of peace with us.

(e) I desire to know what Themsitocles did and why he was called great.

(f) Tell me where you will be tomorrow.

Faculty of Arts and Sciences

CAESAR: VERGIL: LATIN PROSE
(Latin B)

Tuesday, April 13th. Morning, 9 to 12

1. Translate into English:—

Caesar id quod erat suspicatus, aliquid novi a barbaris initum consilii, cohortes quae in stationibus erant secum in eam partem proficisci, ex reliquis duas in stationem cohortes succedere, reliquas armari et confestim sese subsequi iussit. Cum paulo longius a castris processisset, suos ab hostibus premi atque aegre sustinere et conferta legione ex omnibus partibus tela conici animadvertit. Nam quod omni ex reliquis partibus demesso frumento pars una erat reliqua, suspicati hostes huc nostros esse venturos, noctu in silvis delituerant; tum dispersos depositis armis in metendo occupatos subito adorti, paucis interfectis reliquos incertis ordinibus perturbaverant, simul equitatu atque essedis circumdederant.

(a) Write notes on the syntax of: novi consilii, paulo, esse venturos.

(b) Incertis ordinibus. What weakness of the Roman military system is here revealed? Give a general impression of the effectiveness of the British resistance in these two campaigns.

(c) Give the principal parts of: initum, proficisci, iussit, premi, conici, venturos, adorti, circumdederant.

2. Translate into appropriate English prose:—

Atque illum talis iactantem pectore curas
tristior et lacrimis oculos suffusa nitentis
adloquitur Venus: 'O qui res hominumque deumque
aeternis regis imperiis et fulmine terres,
quid meus Aeneas in te committere tantum,

quid Troes potuere, quibus tot funera passis
cunctus ob Italiam terrarum clauditur orbis?
Certe hinc Romanos olim volventibus annis,
hinc fore ductores, revocato a sanguine Teucri,
qui mare, qui terras omni dicione tenerent,
pollicitus—quae te, genitor, sententia vertit?

(a) Scan completely the three verses beginning "certe hinc".

(b) Write notes on :—Antenor, Ascanius, Dido, Sychaeus Achates, Achilles, Paris.

3. Translate into appropriate English prose : –

Postquam introgressi et coram data copia fandi,
maximus Ilioneus placido sic pectore coepit:
'O regina, novam cui condere Iuppiter urbem
iustitiaque dedit gentis frenare superbas,
Troes te miseri, ventis maria omnia vecti,
oramus: prohibe infandos a navibus ignis,
parce pio generi et propius res aspice nostras.
Non nos aut ferro Libycos populare Penatis
venimus, aut raptas ad litora vertere praedas;
non ea vis animo nec tanta superbia victis.

(a) Explain the supposed connection of Roman history with the Troy legend.

(b) Aeneas is a hero scarcely mentioned in Homer. What advantage can you discern in this fact for Vergil's purposes?

(c) Scan completely the first two lines.

4. Translate into English at sight :—

The Parthian Manner of Fighting.

Comminus[1] in acie proeliari aut urbes obsidione[2] expugnare nesciunt. Pugnant aut procurrentibus equis aut terga dantibus; saepe etiam fugam simulant ut ii qui insequantur incautiores sint. Nec diu pugnare possunt; essent intolerabiles si tantam perseverantiam haberent quanta[3] est eis vis impetus. Munimentum[4] et sibi ipsis et equis sunt loricae[5] plumatae qua totum corpus utriusque[6] tegunt.

[1] At close range. [2] Siege. [3] As. [4] Defensive armor. [5] Cuirass. [6] Both.

5. Translate into Latin:

(1) Caesar put the centurions whom he valued (*aestimo*) most, in charge of these legions.

(2) Your recollection of us will touch my father greatly.

(3) When the camp had been fortified he drew up his line of battle at a small distance from the enemy.

(4) Let him not think us unworthy of confidence because these things have been forgotten! (For "because" use abl. abs. constrn. with *omitto* as verb).

(5) In order that these things might not happen, we decided to remain at home.

(6) The men came in such numbers that we could not keep them away from the rampart.

FACULTY OF ARTS AND SCIENCES

CICERO: HORACE

(Latin 1)

Tuesday, April 13th. Morning, 9.00 to 12.00

1. Translate:—

O praeclaram sapientiam! solem enim e mundo tollere videntur qui amicitiam e vita tollunt, qua nihil a dis inmortalibus melius habemus, nihil iucundius. Quae est enim ista securitas? Specie quidem blanda, sed reapse multis locis repudianda; neque enim est consentaneum ullam honestam rem actionemve, ne sollicitus sis, aut non suscipere aut susceptam deponere. Quod si curam fugimus, virtus fugienda est, quae necesse est cum aliqua cura res sibi contrarias aspernetur atque oderit, ut bonitas malitiam, temperantia libidinem, ignaviam fortitudo. Itaque videas rebus iniustis iustos maxime dolere, inbellibus fortes, flagitiosis modestos. Ergo hoc proprium est animi bene constituti, et laetari bonis rebus et dolere contrariis.

Explain the subjunctive *aspernetur*.

2. Translate:—

Est etiam quaedam calamitas in amicitiis dimittendis non numquam necessaria; iam enim a sapientium familiaritatibus ad vulgares amicitias oratio nostra delabitur. Erumpunt saepe vitia amicorum tum in ipsos amicos, tum in alienos, quorum tamen ad amicos *redundet* infamia: tales igitur amicitiae sunt remissione usus eluendae et, ut Catonem dicere audivi, dissuendae magis quam discindendae, nisi quaedam admodum intolerabilis iniuria exarserit, ut neque rectum neque honestum sit nec fieri possit ut non statim alienatio disiunctioque facienda sit. Sin autem aut morum aut studiorum commutatio quaedam, ut fieri solet, facta erit, aut in rei publicae partibus dissensio intercesserit—loquor enim iam, ut paulo ante dixi, non de sapientium sed de communibus amicitiis—cavendum erit ne non solum amicitiae depositae, sed etiam inimicitiae susceptae videantur; nihil enim est turpius quam cum eo bellum gerere, *quicum* familiariter vixeris.

Explain the syntax of words italicized.

3. Translate:—

O fons Bandusiae, splendidior vitro,
dulci digne mero non sine floribus,
cras donaberis haedo,
cui frons turgida cornibus

primis et venerem et proelia destinat;
frustra: nam gelidos inficiet tibi
rubro sanguine rivos,
lascivi suboles gregis.

Te flagrantis atrox hora Caniculae
nescit tangere, tu frigus amabile
fessis vomere tauris
praebes et pecori vago.

Fies nobilium tu quoque fontium,
me dicente cavis impositam ilicem
saxis unde loquaces
lymphae desiliunt tuae.

Explain the genitive *nobilium fontium*.

4. Translate:—

Exegi monumentum aere perennius
regalique situ pyramidum altius,
quod non imber edax, non Aquilo impotens
possit diruere aut innumerabilis
annorum series et fuga temporum.
Non omnis moriar, multaque pars mei
vitabit Libitinam; usque ego postera
crescam laude recens; dum Capitolium
scandet cum tacita virgine pontifex,
dicar, qua violens obstrepit Aufidus
et qua pauper aquae Daunus agrestium,
regnavit populorum ex humili potens,
princeps Aeolium carmen ad Italos
deduxisse modos. Sume superbiam
quaesitam meritis et mihi Delphica
lauro cinge volens, Melpomene, comam.

Explain *Libitina, Aeolium, Delphica lauro,* and the genitive *populorum.*

5. Translate at sight:—

At etiam sunt qui dicant, Quirites, a me in exilium eiectum esse Catilinam. Quod ego si verbo adsequi possem, istos ipsos eicerem, qui haec loquuntur· Homo enim videlicet timidus aut etiam permodestus vocem consulis ferre non potuit; simul atque ire in exilium iussus est, paruit atque ivit. Hesterno die, cum domi meae paene interfectus essem, senatum in aedem Iovis Statoris vocavi, rem omnem ad patres conscriptos detuli: quo cum Catilina venisset, quis eum senator appellavit? quis salutavit? quis denique ita aspexit ut perditum civem, ac non potius ut importunissimum hostem? quin etiam principes eius ordinis partem illam subselliorum, ad quam ille accesserat, nudam atque inanem reliquerunt. Hic ego vehemens ille consul, qui verbo cives in exilium eicio, quaesivi a Catilina, in nocturno conventu apud M. Laecam fuisset necne.

6. Translate into Latin:—

1. There was no one of the Roman who did not envy the eloquence of Cicero.
2. We obey the laws to enjoy freedom.
3. The general blamed the soldiers because they had been defeated by the enemy's cavalry.
4. When the king had been banished, the people created Marcus consul.
5. He wished to remain in the city until his friends should arrive.

7. (a) Explain the difference between *antequam* with the subjunctive and *antequam* with the indicative.

(b) When does *quod* ("because") govern the subjunctive?

(c) Mention and illustrate two common uses of the imperfect indicative.

Faculty of Arts and Sciences

SALLUST: VERGIL: LATIN PROSE

(Latin 2.)

Saturday, April 17th. Morning, 9.00 to 12.00

1. (a) Translate into English:

At Catilinae crudelis animus eadem illa movebat, tametsi praesidia parabantur et ipse lege Plautia interrogatus erat ab L. Paulo. postremo dissimulandi causa aut sui expurgandi, sicut iurgio lacessitus foret, in senatum venit. tum M. Tullius consul, sive praesentiam eius timens sive ira commotus, orationem habuit luculentam atque utilem rei publicae, quam postea scriptam edidit. sed ubi ille adsedit, Catilina, ut erat paratus ad dissimulanda omnia, demisso voltu voce supplici postulare a patribus coepit nequid de se temere crederent; ea familia ortum, ita se ab adulescentia vitam instituisse, ut omnia bona in spe haberet. ne existumarent sibi patricio homini, cujus ipsius atque maiorum pluruma beneficia in plebem Romanam essent, perdita re publica opus esse, cum eam servaret M. Tullius, inquilinus civis urbis Romae. ad hoc maledicta alia cum adderet, obstrepere omnes, hostem atque parricidam vocare. tum ille furibundus 'quoniam quidem circumventus' inquit 'ab inimicis praeceps agor, incendium meum ruina restinguam.'

(b) Explain the syntax of sui, crederent, ortum, haberet, sibi, re publica.

(c) orationem.....edidit. To what speech does Sallust refer?

(d) inquilinus civis. Explain.

2. Translate at sight:

Interim Albinus renovato bello conmeatum stipendium aliaque, quae militibus usui forent, maturat in Africam portare: ac statim ipse profectus, uti ante comitia

quod tempus haud longe aberat, armis aut deditione aut quovis modo bellum conficeret. at contra Iugurtha trahere omnia et alias deinde alias morae causas facere, polliceri deditionem ac deinde metum simulare, cedere instanti et paulo post, ne sui diffiderent, instare: ita belli modo modo pacis mora consulem ludificare. ac fuere qui tum Albinum haud ignarum consili regis existumarent, neque ex tanta properantia tam facile tractum bellum socordia magis quam dolo crederent. sed postquam dilapso tempore comitiorum dies adventabat, Albinus Aulo fratre in castris pro praetore relicto Romam decessit.

3. (a) Translate into English:

At patiens operum parvoque assueta iuventus
aut rastris terram domat aut quatit oppida bello.
Omne aevum ferro teritur, versaque iuvencum
terga fatigamus hasta; nec tarda senectus
debilitat vires animi mutatque vigorem:
canitiem galea premimus, semperque recentes
comportare iuvat praedas et vivere rapto.
Vobis picta croco et fulgenti murice vestis,
desidiae cordi, iuvat indulgere choreis,
et tunicae manicas et habent redimicula mitrae.
O vere Phrygiae (neque enim Phryges), ite per alta
Dindyma, ubi assuetis biforem dat tibia cantum,
tympana vos buxusque vocat Berecyntia Matris
Idaeae: sinite arma viris et cedite ferro.

(b) Explain the case of iuvencum, cordi, choreis.
(c) Write notes on Dindyma, biforem.
(d) What is the occasion of this speech?

4. (a) Translate into English:

'Per patris hospitium et mensas, quas advena adisti,
te precor, Alcide, coeptis ingentibus adsis.
Cernat semineci sibi me rapere arma cruenta,
victoremque ferant morientia lumina Turni.'
Audiit Alcides iuvenem, magnumque sub imo
corde premit gemitum lacrimasque effundit inanes.
Tum genitor natum dictis affatur amicis:

'Stat sua cuique dies, breve et irreparabile tempus
omnibus est vitae: sed famam extendere factis,
hoc virtutis opus. Troiae sub moenibus altis
tot nati cecidere deum; quin occidit una
Sarpedon, mea progenies. Etiam sua Turnum
fata vocant, metasque dati pervenit ad aevi.'

(b) Explain references of "Alcide."

(c) "Per patris.... Turni". Who is the speaker?

(d) Mark the scansion of the first three lines.

4. Translate at sight:

Et iam Fama volans, tanti praenuntia luctus,
Evandrum Evandrique domos et moenia replet,
quae modo victorem Latio Pallanta ferebat.
Arcades ad portas ruere et de more vetusto
funereas rapuere faces; lucet via longo
ordine flammarum et late discriminat agros.
Contra turba Phrygum veniens plangentia iungit
agmina. Quae postquam matres succedere tectis
viderunt, maestam incendunt clamoribus urbem.
At non Evandrum potis est vis ulla tenere,
sed venit in medios. Feretro Pallanta reposto
procubuit super atque haeret lacrimansque gemensque,
et via vix tandem voci laxata dolore est:
'Non haec, o Palla, dederas promissa parenti,
cautius ut saevo velles te credere Marti.'

6. Translate into Latin:

In reply to this Quintus Cicero gave but one answer, namely, that it was not the policy of the Roman people to accept any terms from an enemy in arms; but if they were willing to lay down their arms, they might send ambassadors to Caesar; and in view of his fairness, he hoped they would gain the things they asked.

FACULTY OF ARTS AND SCIENCES

CICERO; LUCRETIUS

(Latin 51)

Friday, April 16th. Morning 9 to 12

1. Translate into English:

A. d. viii Id. Febr. Milo adfuit. Dixit Pompeius, sive voluit; nam ut surrexit, operae Clodianae clamorem sustulerunt, idque ei perpetua oratione contigit, non modo ut acclamatione, sed ut convicio et maledictis impediretur. Qui ut peroravit—nam in eo sane fortis fuit; non est deterritus; dixit omnia, atque interdum etiam silentio cum auctoritate peregerat—sed ut peroravit, surrexit Clodius. Ei tantus clamor a nostris (placuerat enim referre gratiam) ut neque mente nec lingua neque ore consisteret. Ea res acta est, cum hora sexta vix Pompeius perorasset, usque ad horam viii, cum omnia maledicta, versus denique obscenissimi in Clodium et Clodiam dicerentur. Ille furens et exsanguis interrogabat suos in clamore ipso quis esset qui plebem fame necaret. Respondebant operae: "Pompeius". Quis Alexandream ire cuperet. Respondebant "Pompeius". Quem ire vellent. Respondebant "Crassum". Is aderat tum Miloni animo non amico. Hora fere nona quasi signo dato Clodiani nostros conspuere coeperunt. Exarsit dolor. Urgere illi ut loco nos moverent. Factus est a nostris impetus; fuga operarum; eiectus de rostris Clodius, ac nos quoque tum fugimus ne quid in turba. Senatus vocatus in curiam. Pompeius domum.

(Ad Q. Fr. II, 3).

(a) Point to distinctive features of the epistolary style in this extract.

2. Translate carefully into suitable English:

Tum porro quoniam est extremum quodque cacumen
corporibus quod iam nobis minimum esse videtur,
debet item ratione pari minimum esse cacumen
corporis illius quod nostri cernere sensus

iam nequeunt; id nimirum sine partibus exstat
et minima constat natura nec fuit umquam
per se secretum neque posthac esse valebit,
alterius quoniamst ipsum pars, primaque et una
inde aliae atque aliae similes ex ordine partes
agmine condenso naturam corporis explent;
quae quoniam per se nequeunt constare, necessest
haerere unde queant nulla ratione revelli.
Sunt igitur solida primordia simplicitate
quae minimis stipata cohaerent partibus arte,
non ex illarum conventu conciliata,
sed magis aeterna pollentia simplicitate,
unde neque avelli quicquam neque deminui iam
concedit natura reservans semina rebus.

(I, 599-614)

(a) What is the nature of the objection to the Epicurean physics which Lucretius here seeks to meet? Comment on the character of the argument and also on general weaknesses in the Lucretian logic.

(b) Comment on: nimirum (origin and use); per se (as a philosophical term); primordia (meaning, in which connection mention other terms for same idea); simplicitate (metre); conciliata (as a technical term).

3. Translate carefully into suitable English:

O genus infelix humanum, talia divis
cum tribuit facta atque iras adiunxit acerbas!
quantos tum gemitus ipsi sibi, quantaque nobis
vulnera, quas lacrimas peperere minoribu' nostris!
Nec pietas ullast velatum saepe videri
vertier ad lapidem atque omnis accedere ad aras
nec procumbere humi prostratum et pandere palmas
ante deum delubra nec aras sanguine multo
spargere quadrupedum nec votis nectere vota,
sed mage pacata posse omnia mente tueri.
Nam cum suspicimus magni caelestia mundi
templa super stellisque micantibus aethera fixum,
et venit in mentem solis lunaeque viarum,

tunc aliis oppressa malis in pectora cura
illa quoque expergefactum caput erigere infit,
nequae forte deum nobis immensa potestas
sit, vario motu quae candida sidera verset.
(V, 1194-1210).

(a) Compare the theological attitudes of Epicurus and Lucretius, and suggest an explanation for the difference.

4. Translate into English at sight:

Hac a me sententia dicta, magnus animorum factus est motus, cum eorum quorum oportuit, tum illorum etiam quorum numquam putaram; nam, hoc senatusconsulto in meam sententiam facto, Pompeius, cum mihi nihil ostendisset se esse offensum, in Sardiniam et in Africam profectus est, eoque itinere Lucam ad Caesarem venit. Ibi multa de mea sententia questus est Caesar, quippe qui etiam Ravennae Crassum ante vidisset, ab eoque in me esset incensus. Sane moleste Pompeium id ferre constabat. Quod ego cum audissem ex aliis, maxime ex meo fratre cognovi; quem cum in Sardinia Pompeius paucis post diebus quam Luca discesserat convenisset, "Te" inquit, "ipsum cupio; nihil opportunius potuit accidere; nisi cum Marco fratre diligenter egeris dependendum tibi est quod mihi pro illo spopondisti." Quid multa? questus est graviter, sua merita commemoravit, seque quae de mea salute egisset, voluntate Caesaris egisse ipsum meum fratrem testatus est; cuius causam dignitatemque mihi ut commendaret, rogavit ut eam ne oppugnarem, si nollem aut non possem tueri. (Cic. ad Fam. I 9).

In meam sententiam—in accordance with the terms of my speech.
Dependo—pay. Spondeo—guarantee. Voluntate Caesaris—with Caesar's approval.

5. Translate into Latin:

(NOTE: Students in the general course will translate only to the *).

My dear Paetus:

I have, as I think you know, great intimacy with Marcus Fadius, and I am very fond of him, not merely because of his great uprightness and remarkable modesty, but also because in

those disputes which I have with your Epicurean fellow-tipplers (combibo, 3 decl.) I am wont to make use of his assistance in no small degree. When he had joined me at Laodicea and I was wanting him to stay with me, he suddenly was overwhelmed (percutio) with the most alarming letters, the contents of which were that a farm at Herculaneum (adj. in ensis) had been put up for sale (proscribo) by his brother Q. Fadius, although the farm was their joint property. M. Fadius was excessively vexed, and has concluded that his brother, no very shrewd fellow, has gone thus far at the instigation (impulsus) of personal enemies.* Now, my dear Paetus, kindly undertake the whole business and release Fadius from his troubles. We need your backing, your advice, and what is more, your influence. Don't allow these brothers go to law (litigo, 1) and get put outs (conflicto, 1) by discreditable suits. It is Mato and Pollio whom Fadius reckons his personal enemies. Wyh make a long story of it? I cannot, Heaven knows, write in proportion to (tam . . . quam) the favor you will do me if you put Fadius at his ease. He feels that the whole thing is in your hands and persuades me to that effect. Feb. 3.

FACULTY OF ARTS AND SCIENCES

PROPERTIUS

(Latin 101 a)

Phursday, April 15th. Afternoon, 2.00 to 5.00.

1. Explain:—codex (as distinguished from volumen), manus recentior, gloss, conjectural emendation, dittography, homoeoteleuton, uncial, rustic capital, palimpsest.
2. Without translating the following passage explain fully the bearing upon it of the apparatus criticus. Interpret also the significance of the various signs and letters which the apparatus criticus employs.

Forsitan haec illis fuerint mandata tabellis:
"Irascor quoniam es, lente, moratus heri.
an tibi nescio quae viso est formosior an tu
non bona de nobis crimina ficta iacis?"
aut dixit: "Venies hodie, cessabimus una:
hospitiu mtota nocte paravit Amor."
et quaecumque dolens reperit non stulta puella,
garrula cum blandis ducitur hora dolis.
me miserum, his aliquis rationem scribit avarus
et ponit diras inter ephemeridas!
quas si quis mihi rettulerit, donabitur auro:
quis pro divitiis ligna retenta velit?
i puer, et citus haec aliqua propone columna,
et dominum Esquiliis scribe habitare tuum.

11 *fuerint* N; *fuerant* ceteri; *fuerunt* Enk.
14 *Bona* O; *bene* S.
15 *dixit* S: *dixi* O: *dixti* S.
16 *paravit* O: *parabit* Heinsius
17 *dolens* O: *volens* Brockhuyzen. Punctum post *puella*
18 *dolis* O: *iocis* Itali: *notis* Baehrens.
19 *avarus* S: *avari* O; *aliquid . . . avari* R. Ellis
20 *diras* Nf: *duras* ceteri.
22 *ligna* Beroaldus ex emend; *signa* O.

3. Translate into English:—

Nos, ut consuemus, nostros agitamus amores,
atque aliquid duram quaerimus in dominam;
nec tantum ingenio quantum servire dolori
cogor et aetatis tempora dura queri.
Hic mihi conteritur vitae modus, haec mea fama est,
hinc cupio nomen carminis ire mei.
me laudent doctae solum placuisse puellae,
Pontice, et iniustas saepe tulisse minas;
me legat assidue post haec neglectus amator,
et prosint illi cognita nostra mala.
Te quoque si certo puer hic concusserit arcu,
(quod nolim! nostros te violasse deos!)
longe castra tibi, longe miser agmina septem
flebis in aeterno surda iacere situ;
et frustra cupies mollem componere versum,
nec tibi subiciet carmina serus Amor.
Tum me non humilem mirabere saepe poetam,
tunc ego Romans praeferar ingeniis. (1, 7, 5-22).

4. Translate into English:—

Quandocumque igitur nostros mors claudet ocellos,
accipe quae serves funeris acta mei.
Nec mea tunc longa spatietur imagine pompa,
nec tuba sit fati vana querela mei;
nec mihi tunc fulcro sternatur lectus eburno,
nec sit in Attalico mors me nixa toro.
Desit odoriferis ordo mihi lancibus, adsint
plebei parvae funeris exsequiae.
Sat mea, sat magnast, si tres sint pompa libelli
quos ego Persephonae maxima dona feram.
Tu vero nudum pectus lacerata sequeris,
nec fueris nomen lassa vocare meum,
asculaque in gelidis pones suprema libellis,
cumdabitur Syrio munere plenus onyx.
Deinde ubi suppositus cinerem me fecerit ardor,
accipiat Manis parvula testa meos,
et sit in exiguo laurus super additabusto,
quae tegat exstincti funeris umbra locum,
et duo sint versus: QUI NVNC IACET HORRIDA
PVLVIS
VNIVS HIC QVONDAM SERVVS AMORIS ERAT.
(11, 13, 16-36).

5. Translate into English at sight:—

On his way to the East with Messalla Tibullus was taken ill at Corcyra (Phaeacia). The following verses are part of a soliloquy on his situation.

Ibitis Aegaeas sine me, Messalla, per undas,
o utinam memores ipse cohorsque mei:
me tenet ignotis aegrum Phaeacia terris:
abstineas avidas, Mors, precor atra manus.
Abstineas, Mors atra, precor: non hic mihi mater
quae legat in maestos ossa perusta sinus,
non soror Assyrios cineri quae dedat odores
et fieat effusis ante sepulcra comis.
Delia non usquam, quae me cum mitteret urbe,
dicitur ante omnes consuluisse deos.
Illa sacras pueri[1] sortes ter sustulit: illi
rettulit e trinis omina certa puer.
Cuncta dabant reditus; tamen est deterrita numquam
quin fleret nostras despueretque[2] vias.
Ipse ego solator, cum iam mandata dedissem,
quaerebam tardas anxius usque moras.
Aut ego sum causatus aves aut omina dira
Saturnive sacram me tenuise diem[3].
o quotiens ingressus iter mihi tristia dixi
offensum in porta signa dedisse pedem!
Audeat invito nequis descedere Amore,
aut sciat egressum se prohibente deo.

(Pibullus, 1, 3, 1-22.)

[1]Puer: a boy employed to draw the sortes from an urn.
[2]Despuo: protest against (lit. spue out).
[3]Saturni dies: the Jewish Sabbath, held by the superstitious Roman to be an unlucky day for beginning a business.

Faculty of Arts and Sciences

ADVANCED LATIN SYNTAX
(Latin 101b)

Saturday, April 17th. Morning, 9.00 to 12.00.

1. (a) Discuss the composite character of the ablative case, and explain briefly how you would classify under this scheme the ablative of comparison, the ablative with *utor,* the ablative of time, the ablative absolute.
   (b) Explain how the accusative of extent of space and the accusative of the limit of motion may be regarded as developments of the cognate accusative.
2. Outline the points of special interest in the law of the sequence of tenses as connected with (a) clause of result, (b) clauses dependent on an infinitive or a participle, (c) conditional clauses in the indirect narration.
3. Discuss with some fullness the syntax of the italicized words in the following:
   (a) Sed quid *Tulliola mea* fiet?
   (b) Ceterorum servorum ea causa est ut, si res a nobis abisset, liberti nostri *essent.*
   (c) Si est reditus nostri, eam *confirmes.*
   (d) *Nescio quoius* esset haec perscribere.
   (e) Amicitiam nostram testificor me, postquam Caesarem convenerim sententiamque eius qualis *futura esset* parta victoria *cognorim,* te certiorem fecisse.
   (f) Te sociam studeo *scribendis versibus* esse.
   (g) Nunc ratio nulla est restandi, nulla facultas, *aeternas* quoniam *poenas* in morte timendumst.
   (h) Anulus in digito subter tenuatur *habendo.*

(i) Proinde ubi se *videas* hominem *indignarier* ipsum,
post mortem *fore ut* aut *putescat* corpore posto
aut flammis *interfiat* malisve ferarum,
scire licet non sincerum sonere.

(j) Quaerendum est quid sit amari
tanto opere.

(k) quorum unus Homerus
sceptra potitus eadem aliis sopitu' quietest.

(l) Quod tamen expleri nulla ratione *potestur.*

THE JANE ALEXANDER MEMORIAL PRIZE IN LATIN
1915

First Paper

Friday, March 12th. Afternoon, 1.00 to 3.00

The Majesty of the Law.

Ut tibi concedam, hoc indignum esse (quod cuiusmodi sit, iam videro); tu mihi concedas necesse est, multo esse indignius in ea civitate, quae legibus contineatur, discedi a legibus. Mens, et animus, et consilium, et sententia civitatis posita est in legibus. Ut corpora nostra sine mente, sic civitas sine lege, suis partibus, ut nervis ac sanguine et membris, uti non potest. Legum ministri, magistratus: legum interpretes, iudices; legum denique idcirco omnes servi sumus, ut liberi esse possimus. Quid est, Q. Naso, cur tu in isto loco sedeas? quae vis est, qua abs te hi iudices ,tali dignitate praediti, coerceantur Vos autem, iudices, quamobrem ex tanta multitudine civium tam pauci de hominum fortunis sententiam fertis? quo iure Attius, quae voluit, dixit? cur mihi tamdiu potestas dicendi datur? quid sibi autem illi scribae, quid lictores, quid ceteri, quos apparere huic quaestioni video, volunt? Opinor haec omnia lege fieri, totumque hoc iudicium (ut ante dixi) quasi mente quadam regi legis et administrari.

Cicero, pro Cluentio, 53,98

Q. Naso, the presiding Judge, iudices, the Jury.
Attius, Counsel for the prosecution.

2. Translate at sight:

The Just Administration of Aratus at Sicyon.

O virum magnum dignumque qui in nostra republica natus esset! Sic par est agere cum civibus, non (ut his iam vidimus) hastam in foro ponere et bona civium voci subicere praeconis. At ille Graecus (id quod fuit sapientis et praestantis viri) omnibus consulendum putavit ;eaque est summa

ratio et sapientia boni civis, commoda civium non devellere, atque omnes aequitate eadem continere. *Habitent gratis in alieno.* Quid ita? Ut, cum ego emerim, edificarim, tuear, impendam, tu, me invito, fruare meo? Quid est aliud, aliis sua eripere, aliis dare aliena? Nulla autem res vehementius rempublicam continet, quam fides: quae esse nulla potest, nisi erit necessaria solutio rerum creditarum.

Cicero, de Off. ii. 23, 83.

hastam ponere,—to hold an auction.

Habitent gratis in alieno—This is quoted as Caesar's edict, which ordained a remission of house-rent for a certain period.

necessario solutio—strict payment.

3. Translate at sight:

An Exile consoled by his Mother

Cui genetrix flenti 'fortuna viriliter' inquit
'(Siste, precor, lacrimas) ista ferenda tibi est.
Sic erat in fatis: nec te tua culpa fugavit
Sed Deus; offenso pulsus es urbe deo.
Non meriti poenam pateris, sed numinis iram:
Est aliquid magnis crimen abesse malis.
Nec tamen ut primus maere mala talia passus:
Obruit ingentes ista procella viros.
Omne solum forti patria est, ut piscibus acquor,
Ut volueri vacuo quidquid in orbe patet.

Ovid, Fast. i. 479.

THE JANE ALEXANDER MEMORIAL PRIZE IN LATIN

1915

Second Paper

LATIN PROSE COMPOSITION

Friday, March 19th. Afternoon, 1.00 to 3.00

Translate into Latin:

Miltiades, Aristides, and Themistocles were unjustly condemned and banished by their fellow-citizens, but nevertheless, because they deserved well of their state, are now of such renown not only in Greece but also among us that no one mentions those by whom they were crushed. Which of the Carthaginians was of more value than Hannibal for wisdom, for bravery, for achievements, who for so many years contended single-handed with so many of our generals for empire and glory? Yet he was exiled by his own countrymen, while we see that in our literature and in our recollection, even though an enemy he has been made famous. Therefore let us too neglect present results, let us devote ourselves to the glory of posterity, let us deem that to be best which is most upright, let us hope for what we wish, but resolve to bear what happens. Finally, let us reflect that though the bodies of heroes are mortal ,the glory of their valor is everlasting; we may therefore believe that those who have by their counsels or labors either enlarged or defended or preserved this great state have obtained a glory that will never die.

FACULTY OF ARTS AND SCIENCES
AND
DEPARTMENT OF ARCHITECTURE

ALGEBRA AND TRIGONOMETRY

(Math. 1 b & c)

Omit one question out of each group.

Wednesday, April 21st. Morning, 9 to 12

I

1. The time required by a pendulum to make one vibration varies directly as the square root of its length. If a pendulum 100 centimeters long vibrates once in one second, find the time of one vibration of a pendulum 62 centimeters long.

2. (a) Separate into factors: x^2+2x+4

   (b) Solve for x: $\sqrt{3+2x}+\sqrt{3-2x}=0$.

3. By the use of the binomial theorem find $\sqrt{10}$ correct to three places of decimals.

4. A man agreed to pay for the shoeing of his horse as follows: 1 cent for the first nail, 2 cents for the second nail, 4 cents for the third nail, and so on until the eight nails in each shoe were paid for. What did the last nail cost? How much did he agree to pay in all?

5 If the volume of a rectangular tank with a square base is 4000 cubic inches, show that the area, A sq. in., of its base and four sides is $x^2+\frac{16000}{x}$, where x is the number of inches in one side of the base. Graph A as a function of x. For what length of side is A least?

6. When the volume of air in a bicycle pump is 24 cubic inches, the pressure on the handle is 30 pounds. Later, when the volume of the air is 20 cubic inches, the pressure is 36 pounds. Assume that a proportion exists here, determine whether it is direct or inverse, and find the volume of the air when the pressure is 48 pounds. Graph the volume as a function of the pressure.

II

7. Prove geometrically that
$$\sin (A+B)=\sin A \cos B+\cos A \sin B,$$
where A, B, and $A+B$ are first quadrant angles.

8. When the altitude of the sun is 40°, the length of the shadow cast by a flagpole on a horizontal plane is 90 feet. Find the height of the pole.

9. Prove:

(a) $$\frac{1+\sin\theta}{1-\sin\theta}=(\sec\theta+\tan\theta)^2$$

(b) $$\tan x+\cot x=\frac{2}{\sin 2x}$$

10. A base-line AB 850 feet long is measured along a straight bank of a river; C is an object on the opposite bank; the angles BAC, ABC are observed to be $63^\circ\,40'$ and $37^\circ\,15'$ respectively. Find the distances AC and BC.

FACULTY OF APPLIED SCIENCE

ALGEBRA

(Math. 3).

Tuesday, April 13th. Morning 9 to 12

1. Resolve into partial fractions

$$\frac{4x^2+x+6}{(x+1)(x^2+2)}$$

2. Four equal squares are cut off from the corners of a rectangular sheet of tin, 8 inches long and 5 inches wide. The rest of the sheet is bent so as to form an open box on a rectangular base. What is the volume of the box of greatest capacity which can be formed in this way? Use (1) a graph (2) an accurate analytical method.

3. An inaccurate measure exaggerates all lengths by $\frac{4}{10}$ of 1%. By what percentage are areas deduced from these measurements in error?

4. The pressure of the atmosphere is given in millimetres of mercury by the formula:

$$y = 760.\ e^{-x/8000}$$

where the altitude above the sea level is x meters. Calculate a table of pressures for the altitudes 0, 50, 1000, 50,000 meters. Show that the given relation may be written

$$x = 18421\ (\log 760 - \log y)$$

5. Discuss and plot $x^2 - 4x + 5y + 14 = 0$.

6. Find the equation of the circle whose center is $(-1,-2)$ and which passes through the point (4, 10). What are the gradients of the diameter through (4, 10) and of the tangent to the circle at the same point?

7. Sketch the graphs of $x = \sin(1-t)$, $x = t \sin t$, $x = \sin^{-1} t$, $x = \sin t/t$, $y = \frac{1}{2}(e^x + e^{-x})$, $q = 3.4\ h^{3/2}$, $y + 1 = 3.4\ (5x)^{3/2}$, $y = \frac{2x+1}{x-2}$, $pv^{1.4} = 20$, $x^2 - y^2 = 1$

8. Find the real root of the following equation correct to two places of decimals :

$$x^3+10x-30=0$$

9. The vertices of a quadrilateral are $A(1, 1)$, $B(-1, 5)$, $C(2, 3)$ and $D(0,-2)$. Find (a) its area, (b) the equation of the line through C parallel to AB, (c) the equation of the line joining the middle points of AC and BC, (d) the length BC.

10. A point is moving in a straight line, and at time t seconds from a chosen instant its distance from a fixed point on the line is s feet, where $s=t^3-3t$. Find the average speed between t_0 and t_0+h and use this to find the speed at any time, t_0. Sketch the distance-time and speed-time graphs. What is the minimum speed? When is this attained? What is the peculiarity of the distance-time curve at the corresponding point?

UNIVERSITY OF ALBERTA

FACULTY OF APPLIED SCIENCE

TRIGONOMETRY

(Math. 5)

Monday, April 19th. Afternoon, 2 to 5

Solve the following plane triangles :—

1. $a=556.0$, $b=678.4$, $A=31^\circ 11'$
2. $a=65.43$, $b=58.26$, $c=49.35$
3. State the formulae for the sine and cosine of the sum and difference of two angles. From them deduce the formulae

$$\sin^2 x = \frac{1-\cos 2x}{2}$$

and

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}$$

Solve the following spherical triangles :—

4. $A=138^\circ 16'$, $B=31^\circ 11'$, $C=35^\circ 53'$
5. $c=116^\circ$, $A=70^\circ$, $B=131^\circ 20'$
6. $A=110^\circ 10'$, $B=133^\circ 18'$ $a=147^\circ 6'$

Faculty of Applied Science

MECHANICS.

(Math. 6.)

Tuesday, April 20th. Morning, 9.00 to 12.00

1. Weights of 1 and 5 lbs. are fixed at the extremities of a uniform heavy bar 3 ft. long. The centre of gravity of the whole is one ft. from one end. Find the weight of the bar.

2. A picture weighing 7 lbs. hangs by a cord passing through two hooks and over a small nail. The hooks are 18 inches apart and the cord is 4 ft. long. Find the tension in the cord.

3. A man pushes a garden-roller weighing 80 lbs. up a plank 10 ft. 3 in. long with one end 3 in. above the ground. If the handle is horizontal, find the force applied, and the pressure of the roller on the plank.

4. A body starting from rest on an inclined plane describes 40 ft. in the third second; find the inclination of the plane.

5. Two weights support each other on two smooth inclined planes of the same height, the weights being connected by a string passing over a smooth pulley at the junction of the planes. The angles of the planes are 30° and 60°. What is the ratio of the weights, and the tension in the string?

6. A ball thrown up is caught by the thrower 5 seconds afterward. How high did it go, and with what velocity was it thrown?

7. A six-inch rapid-fire gun discharges 5 projectiles per sec., each weighing 100 lbs., with a velocity of 2800 ft. per sec. What K. E. do the projectiles possess on leav-

ing the gun? What is the H. P. expended?

8. What is the K. E. of a car, weighing 2.5 tons moving 6 miles per hour? What force would stop this car in the time it would take to move 100 ft.?

9. A blacksmith using a 16 lb. sledge strikes 20 times a minute with a velocity of 100 ft. per min. At what rate is he working?

10. (a) A cylindrical jar is immersed mouth downward in water. At what depth will it be one-quarter full of water?

(b) A cubic foot of cork is made to float in water with its top horizontal, and the base is then found to be 2.9 inches below the surface. Find its specific gravity.

FACULTY OF ARTS AND SCIENCES

ALGEBRA

(Math. 7 b)

Tuesday, April 20th. Morning 9 to 12

1. (a) Show how complex numbers can be added, subtracted, multiplied and divided graphically.

   (b) Solve $x^4=8$.

2. Draw the graphs of

   (a) $y=\tan x$.

   (b) $y=4x^4-4x^3-57x^2+9x+108$.

   (c) $y=\log x+\sin x$.

3. Give all the information you can about the roots of $5x^5-3x-1=0$.

4. (a) Find the equation whose roots are greater by $\frac{1}{2}$ than the roots of the equation $16x^4-72x^2-64x-15=0$.

   (b) Find the roots of the equation $16x^4-72x^2-64x-15=0$.

5. Solve graphically the cubic $x^3-4x+4=0$, obtaining the roots correct to two decimal places.

6. Given that $x=3$ is a first approximation of a root of the equation $3x^3-10x^2+3x-10.1=0$, find the true value of x correct to three decimal places by Newton's method.

7. Define the derivative $f'(x)$ of a function $f(x)$ and show graphically its meaning.

8. (a) Find the third derivative of $7x^8+4x+7$.

   (b) Find the slope of the tangent to the curve $x^3+9x^2+2x+7=y$ at the point $x=2$.

9. (a) Explain the meaning of the word "probability" in Mathematics.

   (b) If p_1, p_2, p_3 be the respective probabilities of the happening of three independent events, what will be the chance that

(1) all the events will happen,

(2) none will happen,

(3) at least one will happen,

(4) exactly one will happen,

(5) at least one will fail.

10. Evaluate the determinants

$$\begin{vmatrix} 4 & 1 & 6 \\ 3 & 2 & 1 \\ 1 & 0 & 1 \end{vmatrix} \quad ; \quad \begin{vmatrix} 1 & 2 & 3 \\ 1 & x & x^2 \\ 3 & 2 & 1 \end{vmatrix}$$

FACULTIES OF ARTS AND SCIENCES AND OF APPLIED SCIENCE

CALCULUS

(Math. 9 and 51)

Tuesday, April 20th. Morning, 9 to 12

Students in Mathematics 9 will omit questions 11 and 12; those in Mathematics 51 will omit two of the first ten questions.

1. Find the length of one arch of the cycloid: $x=a(\theta-\sin\theta)$, $y=a(1-\cos\theta)$.

2. Find the radius of curvature of the catenary: $y=\frac{a}{2}\left(e^{x/a}+e^{-x/a}\right)$ at the vertex.

3. Water is flowing through a pipe of length L feet and diameter D feet, under a head of H feet. The flow in cubic feet per minute, is $Q=2356\sqrt{HD^5/(L+30D)}$. If $L=1000$, $D=2$ and $H=100$ determine the change in Q due to an increase of 1% in H; in D.

4. Find the volume of the ellipsoid: $\frac{x^2}{16}+\frac{y^2}{9}+\frac{z^2}{4}=1$.

5. Perform the following integrations: $\int x^2\,dx/(1+x)$, $\int \cot 3x\,dx$, $\int x\sqrt{a^2-x^2}\,dx$, $\int \sqrt{a^2-x^2}\,dx$, $\int \log x\,dx$, $\int 10^x dx$.

6. Find the area enclosed by the cardioid $\rho=a(1-\cos\theta)$. Express the gradient of this curve at any point (ρ,θ) as a function of θ.

7. (a) Find an approximating polynomial of the third degree to replace $\sin x$ near $x=0$ and determine the error in using it up to $x=\pi/18=10^\circ$. By about what percentage of either does $\sin 1^\circ$ differ from its arc in the unit circle?

   (b) Assuming that e^x can be developed in a Taylor's Series about any value of x, obtain the developments about $x=a$ and $x=0$.

8. Find (a) the centre of gravity of a circular sector of angle 2α, (b) of a semicircle. Find (c) the radius of gyration of a sphere about a diameter.

9. A body moves in a straight line and s feet is its distance from a fixed point O in the line at the end of t seconds. The acceleration is $9s$ ft./sec^2 towards O. When $t=0$, the body is 15 feet to the right of O and when $t=\pi/6$ it is 20 feet to the right of O. Show that $s=25\sin(3t+\theta)$ where $\theta=\tan^{-1}3/4$. Describe the motion of the body.

10. A straight road runs along the edge of a common; and a person on the common, at a distance of 1 mile from the nearest point A of the road, wishes to go to a distant place B on the road in the least time possible. If his rates of walking on common and road are 4 and 5 miles an hour, respectively, where must he strike the road?

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11. Plot the curve whose parametric equations are $x=25\cos\theta$, $y=16\sin\theta$. Show that it is an ellipse; find its ordinary equation and the coordinates of its foci.

12. By the translation of the axes, remove as many terms as possible from the equation of the parabola $y^2+4x+4y-2=0$

Faculty of Applied Science

MECHANICS.

(Math. 11.)

Saturday, April 17th. Morning, 9.00 to 12.00

1. A particle is projected with initial velocity Vo at an angle α with the horizontal.
   Find (a) the maximum height attained;
   (b) the range;
   (c) the angle of elevation for maximum range.
2. A train of 100 tons, excluding the engine, runs up a 2 per cent. grade with an acceleration of 1 ft. per sec. per sec. If the coefficient of friction is .2 find the pull on the drawbar of the engine.
3. A particle resting upon the highest point of a smooth horizontal cylinder of radius r slides off. Show that it leaves the cylinder after descending a distance of $\frac{r}{3}$.
4. The spring of an automobile deflects 4 in. under a suddenly applied load. Find the period of vibration.
5. The weight of a pile-driver is 10 tons. It falls through a height of 20 ft. on a pile weighing 2 tons, driving it 2 inches into the earth. Find the exact average resistance of the earth.
6. A ball falls from a height h on a level floor. Find the total distance traversed before it comes to rest and the total time taken, given that e equals the coefficient of restitution.
7. A wheel 6 ft. in diameter has a moment of inertia of 600 lb. ft.^{2}, and is turning at the rate of 50 r.p.m. What opposing force applied tangentially to the rim will bring it to rest in one minute?

8. How much faster would the earth rotate on its axis if it contracted so that its radius was 2000 miles?

9. What is the horse-power of an engine that will give a fly-wheel of radius 4 ft. weighing 6 tons a velocity of 120 r.p.m. in 5 minutes?

10. Two bodies weighing 12 and 8 pounds move in the same direction with velocities of 8 and 4 ft. per sec. Find the velocities after collision and the loss of K. E., given that e equals $\frac{1}{2}$.

FACULTY OF ARTS AND SCIENCES

ADVANCED CALCULUS

(Math. 52)

Monday, April 12th. Afternoon 2 to 5

1. Perform the following integrations:

$$\int \cos^2 x \sin^2 x \, dx, \quad \int \frac{x^2}{\sqrt{1-x^3}} dx, \quad \int \frac{x^2}{1-x^2} dx$$

2. If $y = P(x)$ is a polynomial in x such that the equation $P(x) = 0$ has multiple roots, show that $P'(x) = 0$ for each multiple root. Show that if $27b^2 + 4a^3 = 0$ the equation $x^3 + ax + b = 0$ will have two equal roots.

3. By any method that is applicable, expand $\log(1+x)$ in powers of x. Show that the remainder is less than the last term if x is positive. Compute $\log 1.1$, correct to six places.

4. By successive integration by parts and subsequent solution show

$$\int e^{2x} \sin x dx = \frac{e^{2x}(2 \sin x - \cos x)}{5}$$

5. Solve two of the following equations:

$$(x - y^2)dx + 2xydy = 0.$$

$$\frac{dy}{dx} + y \cos x = \tfrac{1}{2} \sin 2x.$$

$$x + y\frac{dy}{dx} = 2y.$$

6. Solve, by two different methods, the equation

$$\left(\frac{dy}{dx}\right)^2 = y.$$

Determine the singular solution, showing its relation to the general solution by means of a sketch.

7. Show that the orthogonal trajectories of the family of parabolas $y^2 = kx$ are a family of ellipses.

8. Integrate $a^2 y''y' = x$

9. Write a note on the complex number system, dealing with the fundamental definitions and theorems, graphical representation, etc.

10. Discuss the continuity of the functions:

$$y=\sin\frac{1}{x};\ y=x\sin\frac{1}{x};\ y=x^2\sin\frac{1}{x};\ z=\frac{x+y}{x-y}.$$

Do these functions possess derivatives?

Faculty of Arts and Sciences

ASTRONOMY

(Math. 53.)

Tuesday, April 13th. Afternoon, 2.00 to 5.00

1. Describe the following instruments and give their principal uses:
   (a) Meridian-circle.
   (b) Chronometer.
   (c) Spectroscope.
   (d) Equatorial telescope.
2. Write a note on time and the calendar.
3. Give the cause of tides, and a short account of Darwin's tidal theory.
4. Describe briefly the comets.
5. Give the different members of the solar system with their outstanding characteristics and dimensions.
6. Indicate the principal features of the surface of the Sun and its surroundings.
7. Describe a method for determining the Sun's motion relative to the stars.
8. Give the different theories regarding the size, construction and motion of the universe.
9. Write a note on radial motions.
10. Give the names of the men prominent in astronomy with their work and discoveries.

FACULTY OF APPLIED SCIENCE

MINE MAPPING AND SURVEYING.

(Min. Eng. 51.)

Wednesday, April 14th. Morning, 9.00 to 12.00

1. Enunciate and explain the different methods of reading horizontal angles. How would you read horizontal angles that were required to be more accurate than the vernier reading of the horizontal circle would give?

2. The complete plans of a mine are required. The mine is working a vein of gold quartz ore dipping at 60 degrees. A transit, 200 foot tape and plummet lamps are available. How would you carry out the survey and what notes would you take? Explain the notes. How would you show graphically the assay values of the ore in the mine.

   The mine is entered by an inclined shaft along the vein.

3. Calculate the bearing, inclination and inclined distance between the points "D" and "G" of the following survey:

Sta.	Hor. Ang.	Ver. Ang.	Tape.	H.I.	H.S.
A—B	79°16' R.	6°00'	80.00	–1.10	2.00
B—C	14 30 R.	3 13	76.26	–2.00	–2.10
C—D	6 16 L.	2 14	42.00	4.10	1.60
A—E	0 20 R.	–54 15	120.18	–1.10	–1.20
E—F	81 00 R.	0 20	108.11	4.20	1.15
F—G	0 30 L.	0 00	100.00	–1.60	0.60

   The back sight at "A" has in each case been taken to station 10. Line 10—A is the meridian.

4. Describe the different methods of carrying a meridian down a shaft.

5. Write briefly upon the methods of taking steep transit sights. Give the adjustments and corrections for eccentricity.

6. Write briefly upon the theory of magnetic surveying of iron ore deposits.

Department of Pharmacy.

MATERIA MEDICA.

Thursday, April 15th. Morning, 9.00 to 12.00

1. What commercial varieties of opium are in use? What limits does the Pharmacopoeia place upon opium used in official preparations? Give an outline of the official assay process.
2. Compare black and white mustard seeds and indicate what the pungent substances are and under what conditions they are formed. For what reason is a mixture of the two seeds used in the preparation of the official mustard plaster?
3. Give an account of *either* (a) cascara bark *or* (b) cinnamon bark. In either case state the geographical and botanical sources of the drug and mention to what substance or substances the medicinal activity is ascribed.
4. From what crude drug is extract of male-fern obtained and by what process? What is the active ingredient in this extract?

FACULTY OF APPLIED SCIENCE

ORE DRESSING

(M.E. 52)

Tuesday, April 13th. Afternoon, 2.00 to 5.00

1. Explain the operation of classification. What are the purposes of a classifier?
2. Sketch and describe two hydraulic classifiers. Which one do you prefer? Why?
3. Describe the standard Hartz jig of, say, 3 compartments and assuming a suitable ore, show how such a jig would effect a separation and how and where each product would be collected.
4. Describe and explain Richard's pulsator jig showing the points of similarity and difference between it and a jig of the Hartz type.
5. Sketch and describe the Frew vanner.
6. Discuss screening and compare it with classification. Write briefly upon the trommel.
7. Sketch and describe the Callow screen.
8. State the two best known theories regarding the relation of reduction in size in rock crushing to the consumption in power and show how these two theories differ from one another.
9. Sketch and describe either the Blake or the Dodge type rock breaker. Give the advantages and disadvantages of each.
10. Give a flow sheet of a mill to treat a quartz,—galena,—zincblende ore to give galena concentrates, zinc blende concentrates and quartz tailings.

Faculty of Applied Science

METALLURGY.

(Min. Eng. 55.)

Saturday, April 17th. Afternoon, 2.00 to 5.00

1. Define fuel. Name some substances, not of vegetable origin, which are used as fuels in certain metallurgical processes, and give the chemical reactions of their combustion.

2. Define,—heat unit, calorific power, evaporative unit. Distinguish between,—calorie, pound calorie, B.T.U. What is meant by "the calorific power of a fuel in evaporative units"?

3. Discuss the physical properties of charcoal.
Write fully upon the preparation of charcoal by the method of circular piles.

4. What is "coke"? Give the physical properties.
Write fully upon the manufacture of Coke in the "Bee Hive" oven.

5. What is "enriched producer gas"? Give a general account of the chemistry of its production with special reference to the part played by steam.
Write briefly upon some *one* type of Gas Producer you know.

6. Write briefly upon Mond gas, Water gas.

7. Discuss the Mahler Bomb *or* the Parr Calorimeter.

8. Define an alloy. What is meant by "eutetic" mixture? Give the composition of the following alloys,—brass, bronze, babbit metal, monel metal, German silver.

9. Write briefly upon the occurrence, preparation and uses of refractory materials.

FACULTY OF ARTS AND SCIENCES

PHILOSOPHY 1.

(Answer only eight questions.)

Monday, April 19th. Morning, 9.00 to 12.00

1. Discuss the localization of mental functions in various brain centres, referring to the methods by which the localization has been determined in each case.
2. Outline the *development* of the consciousness of the self.
3. Discuss Habit under the following heads: physiological basis, rules for acquisition, practical results.
4. Analyze the conditions for the *seeing* of distance (the third dimension).
5. Define and distinguish between perception, apperception, illusion, hallucination, reproduction, association, memory ideas, imaginative ideas.
6. Discuss Attention (a) as a state of consciousness, (b) its physiological conditions.
7. What is the relation of Socrates to the early physical philosophers and to the Sophists?
8. Give an outline of Plato's theory of justice, indicating the basis of this theory and its application to the state.
9. In what respects were the ideals of the Stoics, Epicureans and Sceptics similar? Point out the difference in the manner of realizing their respective ends.
10. Writes notes on the following:
    (a) Aristotle's distinction between the intellectual and the practical virtues.
    (b) Bacon's Idols and their significance to us.
    (c) Hobbes' theory of sensation, memory and imagination.

Faculty of Applied Science

MINING ENGINEERING

(M.E. 56)

Monday, April 12th. Afternoon 2.00 to 5.00.

1. Describe the general methods of blasting rock for tunnels, drifts, shafts, etc., explaining the location, charging and firing of the holes.

2. Write briefly on open cut mining.

3. (a) To what depth can compressed air methods be used in shaft sinking in very wet ground, and why are they thus limited?

   (b) What methods may be employed and which of these would you recommend for sinking a shaft 900 feet deep the first 250 feet of which are to be through very wet ground. Describe briefly the method recommended.

4. Describe the methods of surveying a diamond drill hole and explain the necessity of such surveys.

5. Describe the general methods of handling

   (a) the ore at the shaft station of a metal mine;

   (b) the coal at the pit-bottom of a coal mine.

   Wherein and why do they differ?

6. Write briefly upon subsidence and the "dome of caving."

7. Discuss room and pillar mining in general and describe briefly the different methods of developing and mining a flat seam by the room and pillar method.

8. Write fully upon the different methods of room and pillar mining in pitching seams giving the advantages and disadvantges of each method and the types of seams to which each would be applicable.

9. Write briefly upon the long wall method of mining coal with special reference to the Scotch system.

10. Why is ventilation needed in a mine? Describe very generally the different methods of ventilating a coal mine.

FACULTY OF ARTS AND SCIENCES

PHILOSOPHY 51.

Answer only eight questions.

Friday, April 16th. Afternoon, 2.00 to 5.00

1. What difficulties did Plato see in his early theory of Ideas, and how did he endeavor to overcome these difficulties in his later theory? In how far was he successful?
2. Give an outline of Aristotle's ethical theory.
3. How is the problem of Freedom treated by the Epicureans, the Stoics, Spinoza and Leibnitz respectively?
4. Write notes on the following:
   (a) The result of the struggle between Realism and Nominalism on the subsequent development of thought.
   (b) Bruno's development of the theory of Copernicus.
   (c) Hobbes' theory of the imagination and of religion.
5. Outline Locke's theory of knowledge and give Berkeley's criticism.
6. Discuss fully the meaning of the Scepticism of Hume.
7. Compare the Greek and Hebrew ideals of life.
8. What is the relation of Green's philosophy to the Naturalism of the 19th Century?
9. What is the attitude of the New Realists to the philosophy of Bradley?
10. Discuss:
    (a) the place of reason in the moral life.
    (b) the meaning of duty.

Faculty of Arts and Sciences

PHILOSOPHY 52.

Friday, April 16th. Afternoon, 2.00 to 5.00

Answer eight questions only.

1. "Although our knowledge begins *with* experience, it by no means follows that it originates *from* experience." Explain and give briefly Kant's analysis of experience.
2. How does Kant distinguish between the empirical and the transcendental forms of mental activity? What is the significance of the idea of reason?
3. Outline and examine critically Kant's theory of duty.
4. How is Kant's theory of the beautiful related to his conception of teleology? Show how the conception of teleology makes possible a closer relation between the phenomenal and noumenal worlds.
5. Give the substance of Fichte's "The Vocation of Man".
6. What is the relation of Hegel to Schelling? How does Hegel establish the identity of logic and metaphysic?
7. What do you understand by faith in religion, and what value do you attach to the use of symbols in the religious life?
8. In how far do you consider Höffding's view of the essence of religion adequate?
9. Give an analysis of any four classical paintings with which you are familiar.

FACULTY OF ARTS AND SCIENCES

PHILOSOPHY 101

(Phil. 101.)

Wednesday, April 21st. Morning, 9.00 to 12.00

Answer 8 *questions*

1. How does Plato treat the Sophistic argument that not-being does not exist?
2. What does Plato mean by the "idea of the good"? What is its value in education?
3. "Might is right". How do the Sophists and Plato view this statement? Give and establish your theory.
4. Can reality be conceived of as good? Or is "good" to be confined to man? Discuss these questions in general and also with reference to the positions of Plato and Aristotle.
5. Examine the problem of "social justice", stating the views of Aristotle and any modern writer such as Bosanquet.
6. Is there any universal end of action? Give reasons for and against.
7. Select and defend any one theory of the ultimate end of action.
8. Give Aristotle's theory of the origin of poetry. Contrast it with Ruskin's and examine both.
9. What according to Aristotle is the nature of tragedy? Supplement his view by reference to Goethe, Hegel and Bradley.
10. Expose the psychological elements present in imagination understood as the apprehension of beauty, and include a theory of the ugly. Give illustrations.
11. Consider the question of a time process in the absolute.

Faculty of Arts and Sciences.

CONTEMPORARY PHILOSOPHY

(Philos. 103)

Answer only eight questions.

Monday, April 12th. Morning, 9.00 to 12.00

1. How is Green's Metaphysic related to the Philosophy of Kant?
2. Show by means of examples how Bradley conceives the relation of Appearance to Reality.
3. Give an outline of Bradley's Chapter on Degrees of Truth and Reality.
4. Comment upon the main criticism directed against Absolutism by the Personal Idealists.
5. Write a note on the positive significance of Personal Idealism under the following headings:
   (a) the value of science;
   (b) the limits of evolution;
   (c) the meaning of art.
6. Discuss critically the pragmatic conception of truth.
7. How does James treat the rival hypotheses Monism and Pluralism?
8. Give an exposition of Bergson's Philosophy under the following headings:
   (a) his theory of memory;
   (b) his view of instinct;
   (c) his conception of intuition.
9. What is the epistemological basis of the New Realism? Comment upon the ethical value of this philosophy.

FACULTY OF ARTS AND SCIENCES

PSYCHOLOGY 51.

Tuesday, April 13th. Morning, 9.00 to 12.00

Answer eight questions only.

1. Describe the spinal cord. Draw a section showing the disposition of the *white* and *gray* matter, the principal tracts, the motor and sensory roots, etc.

2. Trace the sensory pathway of the *muscular sense* from the muscles of the trunk to the cerebral cortex; and trace the motor pathway from the cortex to the muscles. How many neurones are involved in each case?

3. State the differences between conduction in the axon and conduction through the reflex arc. How are these differences best explained?

4. Discuss nerve *inhibition* and *facilitation;* and show their relations to certain phenomena of consciousness. Compare McDougall's and Munsterberg's theories of inhibition.

5. Discuss the various lines of evidence for localization of mental functions in the cerebrum. What were the views of Broca, Wernicke and Marie regarding a *speech centre* in the cortex?

6. Describe the various refracting media of the eye; and the layers of the retina; *or* classify the geometric optical illusions, and give six explanations of the Muller-Lyer illusion.

7. Distinguish between the *protopathic* and *epicritic* systems of cutaneous sensations, and describe Head's experiment to prove the relative independence of the systems; *or* state and compare the various theories of the localization of sound.

8. Give a classification of the instincts with their correlative emotions, natural excitants, and abnormal or pathological developments if any.

9. Characterize the differences between: pleasure, joy, happiness; simple emotions, compound emotions, sentiment; bashfulness, shame; reverence, awe.

10. Discuss the instinctive basis of: religion, moral indignation, social reform, social cooperation, artistic production, and scientific achievement.

DEPARTMENT OF PHARMACY

PHARMACY

Tuesday, April 20th. Afternoon, 2.00 to 5.00

1. How much mercuric chloride must be used to prepare 6 fluid ounces of solution so that when one fluid drachm is diluted with water to half a pint it will give a 1 in 2000 solution?
2. State the methods of preparation of liquor arsenicalis and of liquor arsenici hydrochloricus. What is the strength and dose of each? For what reasons are both solutions official?
3. How are the following waters prepared: chloroform, camphor, cherry-laurel, peppermint, dill? In the case of cherry-laurel water, it is standardised in terms of hydrocyanic acid. What is the standard, and how is the test carried out?
4. Starting with absorbent cotton, state how pyroxylin may be prepared. From this pyroxylin, how could you prepare flexible collodion?

Department of Pharmacy.

PHARMACOLOGY.

Saturday, April 17th. Afternoon, 2.00 to 5.00

1. Discuss the following substances as to preparation and mode of action:
   (a) autogenous vaccines;
   (b) anti-bactericidal sera.
2. Detail the drugs causing an increase of blood pressure and their mode of action.
3. Discuss the action of potassium, ammonium, and sodium salts in the body when taken by the mouth.
4. Discuss the hypnotics as a group, and detail typical drugs in the group with their individual actions.
5. Discuss action of caffeine, camphor and strychnine.

FACULTY OF ARTS AND SCIENCES; FACULTY OF MEDICINE.

GENERAL PHYSICS.

(Physics 1a)

Only ten questions to be attempted.

Monday, April 12th. Afternoon, 2.00 to 5.00

1. Define *pressure* and give the laws of fluid pressure. What force must be applied to the top face of a wooden cube, of side 10 cms and density 3 gms. per cub. cm., in order that the cube may be totally immersed in mercury, the density of which is 13.6 gms. per cub. cm.?

2. State the principle of the *Parallelogram of Forces*. Show how a ship is able to sail into the wind.

3. State Newton's *Second* Law of Motion.
A motor car of mass 1 ton travelling at the rate of 40 miles per hour is pulled up in 44 yards. Assuming that the retardation is uniform, find the retarding force and the time taken to bring the car to rest.

4. Write notes on *three* of the following:
   (a) law of Universal Gravitation.
   (b) surface tension.
   (c) relation between heat and mechanical energy.
   (d) the absolute scale of temperature.

5. Distinguish between saturated and unsaturated vapours. If you were given some vapour in a cylinder with a piston and manometer attached, how could you discover whether the vapour is saturated or unsaturated?

6. (a) Define *specific* and *latent* heat.
(b) A mass of 10 gms. of iron at a certain temperature is placed in a copper calorimeter, of mass 100 gms., containing 741 gms. of water, the temperature of which is initially 22 degrees C. It is found that the resulting temperature of the mixture is 30 degrees C. Taking the

specific heats of iron and copper to be 0.12 and 0.09 respectively, calculate the initial temperature of the iron.

7. (a) Distinguish between *longitudinal* and *transverse* waves. Give illustrations.
(b) A bell whose frequency is 160 vibrations per second is sounded under water, and some of the sound waves emerge into the air. What are the lengths of the sound waves in the water and in the air, if the sound travelled four times as fast in the former as in the latter?
(vel. of sound in air = 1,100 feet per second.)

8. (a) Show how the human eye may be regarded as an optical instrument. (Use diagrams in your explanation.)
(b) A magnifying glass of 1.2 inches focal length is held at a distance of 1 inch from an object. Find the position, nature, and magnification of the image. Draw diagram.

9. Give an explanation of the dark lines in the solar spectrum. How would you produce similar dark lines in a spectrum from an artificial source of light?

10. Write briefly on the Earth as a magnet and on the Earth's magnetic field. What is meant by *magnetic declination*, and by *magnetic dip*?

11. Explain, giving diagrams, the *principles* of *two* of the following pieces of apparatus: moving magnet galvanometer, direct current ammeter, storage battery, incandescent lamp.

12. Describe the action of an electric condenser (e.g. a Leyden jar). Give reasons for considering that the discharge of a condenser is oscillatory in character, and indicate how electric waves may be produced by such a discharge.

13. State Ohm's law. A room is lighted at 110 volts by three incandescent lamps arranged *in parallel*. The resistance of each lamp is 500 ohms. What is (a) the current in each lamp, (b) the current flowing in the main wires entering the room, (c) the total power consumed in watts?

FACULTY OF APPLIED SCIENCE.

HEAT, LIGHT AND SOUND

(Physics 3)

Saturday, April 17th. Afternoon, 2.00 to 5.00

Only eight questions to be attempted.

1. (a) Define critical temperature and critical pressure of a gas.

   (b) Give an account of the behavior of a substance near its critical point;

   "Or" Describe a method of preparing liquid air.

2. Distinguish between the external and the internal work done by a gas in expanding. What evidence is there for stating that a gas does internal work? How may the external work be represented diagrammatically?

3. State Huygen's Principle and apply it to derive the new wave front of a plane wave incident obliquely on (a) a plane reflecting surface, (b) a plane refracting surface. ABC is a principal plane of a glass prism whose refracting angle A is 40 degrees. When light is incident along BA it is found that it emerges from the prism perpendicular to AC. What is the refractive index of the glass and the critical angle?

5. Describe a simple form of astronomical telescope and deduce a theoretical expression for its magnifying power.

6. Discuss the different kinds of spectra. What evidence is there for assuming that sodium vapour exists in the sun's atmosphere?

7. What is meant by the term "reversible cycle" in Thermodynamics? Give the conditions for reversibility. Explain the processes in a Carnot cycle. What is the efficiency of an engine performing such a cycle?

8. Using a sonometer and weights how would you find the frequency of a tuning fork?

In such an experiment there is found to be unison between the string and the fork when the length of the string is 80 cms. and the tension is 5 kilograms weight. The density of the material of the string is 8.6 gms. per c.c. and the diameter of the cross section, assumed to be circular, is .5 mms. Calculate the frequency of the fork.

9. Distinguish between real and virtual images. When does a convex lens give a virtual image?

With a convex lens of focal length 15 cms. at what distances from the lens must the object be placed to produce a linear magnification of numeral value 1·6

10. Write notes on the following:

(a) spherical aberration and achromatism of lenses.

(b) Doppler's principle.

(c) Fluorescence and Phosphorescence.

FACULTY OF APPLIED SCIENCE

MAGNETISM AND ELECTRICITY

(Physics 4.)

Monday, April 12th. Afternoon, 2.00 to 5.00

Only eight questions to be attempted.

1. Define the elctro-static and electro-magnetic units of quantity, current, difference of potential and capacity. A condenser has a capacity of one micro-farad. What is its capacity in electro-static units?

2. The magnetic potential at a point P on the axis of a turn of wire carrying a current c is given by

$$V_P = 2\pi c\left(1 - \frac{x}{\sqrt{r^2+x^2}}\right)$$

where r is the radius of the turn and x the distance of P from its centre. Derive (a) an expression for the field strength at the centre of a solenoid, and (b) the tangent galvanometer formula.

3. Explain how it is that a conductor carrying current is acted upon by a force when it is placed in a magnetic field. Show diagrams and determine the force per unit length on a conductor at right angles to the magnetic field.

4. Give a method of measuring (a) a high resistance, (b) a medium resistance, (c) a low resistance. Describe in detail a method of measuring any *one* of them.

5. Given an earth inductor and a ballistic galvanometer, how would you proceed to determine the inclination (angle of dip) of the earth's magnetic field?

6. How does the flux in a piece of iron vary with the magnetising force as the latter is continuously increased and decreased?

   The primary of an induction coil has 180 turns and the secondary 24,000 turns. If the primary current decreases from 5 amperes to zero in .001 sec., what is the E.M.F?

in volts induced in the secondary? The iron core is 15 cm. long and 6 sq. cm. in cross section. Take the permeability as 300.

7. Describe the essential parts and principles of any *two* of the following: modern telephone receiver, duplex telegraph system, direct current shunt motor.

8. A circular coil of wire of 20 turns and 30 cm. diameter is rotated in a uniform magnetic field about a diameter at right angles to the field. The strength of the field is 200 lines per sq. cm. and the speed of the coil is 600 revolutions per minute. Find the instantaneous and average E.M.F. in volts. Explain fully.

9. Write notes giving the essentials points of the following:
   (a) the Peltier and Seebeck effects in thermo-electricity
   (b) the alteration of electrical resistance of metals and alloys with temperature.

10. Describe the arrangements for producing cathode and X-rays. Discuss briefly the properties of each.

FACULTY OF ARTS AND SCIENCES.

GENERAL PHYSICS

(Physics 54)

Friday, April 16th. Morning, 9.00 to 12.00

Only eight questions to be attempted.

1. (a) Explain how the height to which a liquid will rise in a capillary tube depends on the *surface tension of the liquid,* and on the *angle of contact* between the liquid and the material of the tube.

   (b) Describe an experiment to show how the range of molecular action between liquid and solid has been determined.

2. Show that the *refraction* of a system of waves on leaving one medium and entering another is explained by the difference in velocities of the waves in the two media. Prove mathematically that the *index of refraction* is the ratio of these velocities.

3. Explain the principles of *interference* of sound waves. Upon this principle explain the production of (a) beats,

   (b) stationary oscillations.

4. (a) Prove the formula $\frac{1}{p}-\frac{1}{q}=\frac{1}{f}$ for refraction through a *thin, concave* lens.

   (b) Show by diagrams that the image (of a real object) formed by such a lens is virtual, erect and diminished

5. (a) What conclusions concerning the nature of light vibrations in the ether can we draw from the phenomenon of polarization?

   (b) Describe the construction and *explain the principle* of a Nicol prism.

6. Outline briefly the propagation of electro-magnetic waves in the ether. Describe in detail one method of finding the velocity of such waves, and show the variation of fre-

quency corresponding to waves varying in length from 2 kilometers to 2×10^{-5} cms.

7. Write explanatory notes on *three* of the following:
   (a) transference of heat energy by convection
   (b) methods of demonstrating *fluorescense* and *phosphorescence* of light.
   (c) point discharge of electricity.
   (d) dependence of electrical resistance on temperature.

8. State the nature and give the chief characteristics of the following radiations:
   electric waves of wireless telegraphy, the infra-red waves of the solar spectrum, ultra-violet waves of the solar spectrum, cathode rays, X-rays.

9. Show how it follows from theoretical considerations that, in general, a wire carrying a current in a magnetic field is acted on by a mechanical force. Give diagrams. Explain how this force is made use of to drive the rotating part of an electric motor.

10. Define the units: watt, kilowatt-hour, ampere-hour.
    A battery of 40 cells, E. M. F. of each cell 2.1 volts, lights 20 arc lamps arranged parallel. If each arc takes 6 amperes, find the equivalent resistance of each arc and of the whole set of arcs, the current supplied by the battery, and the rate of working of the battery in kilowatts and horse-power.

M.A. and M.Sc. Examination

(Minor subject)

(Physics 101)

IONIZATION AND RADIOACTIVITY

Friday, April 9th. Afternoon.

(Questions 4 and 8 must be attempted)

1. Give the distinctive characteristics of the following rays and radiations: Cathode rays, X-rays, positive rays rays, thermions, α-rays, β-rays, γ-rays, δ-rays. What distinctions can be drawn between X and γ-rays, and, from the manner of their production, what suggestions may be made as to the nature of these radiations?

2. Describe how you would set up an apparatus to investigate the production of ions by the collision of negative ions with gas molecules. State the precautions necessary for the proper adjustment of the measuring instruments, the prevention of electric leakage, and exterior electrostatic effects.

   Having obtained the curve of ionization current on base, show how the constant may be dediced. (X is the intensity of the electric field, is the gas pressure, and α is the number of pairs of ions, produced by collision, by a negative ion moving through one centimetre of the gas.)

3. Give the theory of a method by which the ratio of the *electric charge* to the *mass*, and also the *velocity* of electrons from any one source may be determined. Also, explain one method by which the unit electronic charge has been measured.

4. Explain Rutherford's Theory of Radioactive Transformations, and mention particularly what physical characteristics are peculiar to these changes. (Illustrate your answer by reference to the transformations of the Thorium series.)

   What is the evidence for the conclusion that these

changes cannot be explained by ordinary chemical action?

5. (a) Describe in detail an experimental method for determining the quantity of radium in a given solid mixture or liquid solution. (b) A quantity of radium emanation, P, is mixed with air rand quickly admitted to a receiver. Show how you could deduce the quantities present, after a time t from admission, of emanation, radium A, radium B and radium C. Also indicate how you could approximately deduce the contribution of each of these bodies to the total ionization within the receiver. (Take λ_1, λ_2, λ_3, and λ_4 as the transformation constants of emanation, radium A, radium B, and radium C, respectively.)

6. Discuss the bearing of the determination of the number of α particles from a definite quantity of radium, and of the electric charge on an α particle, on the following subjects:

(a) The identity of a helium molecule with an α particle; (b) the volume of emanation in radioactive equilibrium with a given quantity of radium; (c) the heating effect of radium; (d) the amount of energy required to produce an ion.

7. (a) Prove the relation between the mobility and coefficient of diffusion of ions given by $U=D_P^{Ne}$ where U is the mobility of the ions; D, the coefficient of diffusion ;P, standard barometric pressure; e, the electronic charge ;and N Avogradro's constant.

(b) In an examination of a uranium ore the radium content was found to be 2.14×10^5 gms. Ionium was completely separated from the ore and it was found that radium was produced from this ionium at the rate of 7.44×10^{-9} gms. per year. Determine the half-value period of radium.

8. Discuss the subject of the constitution of matter on a basis of the ideas of modern research. In your discussion include explanations of modern views of the following topics; (a) the possibility of all matter being fundamentally the same; (b) the possibility of mass being entirely electrical in origin; (c) the internal structure of the atom.

M.Sc. Examination.—Major subject

PRINCIPLES ON ELECTRIC WAVES

(Physics 102)

Friday, April 23rd, 1915. Morning, 9.00 to 12.00

(*The first four questions must be attempted; five questions will be considered a full paper.*)

1. (a) Consider the case of any oscillating system where the force of restitution is proportional to the displacement, and the rictional resistance is proportional to the velosity. Construct the differential equation expressing the motion, and show analytically and graphically its solutions, (1) when the resistance is great, (2) when the resistance is of ordinary appreciable magniture, (3) when the resistance is negligible. (Solutions need not be worked out).

   (b) Show now the phenomenon of an electric condenser discharging through an inductive circuit may be treated in a manner analogoes to the case discussed above. Hence deduce an expression or the period of an electric oscillation in a circuit, in terms of the constants of resistance, inductance, and capacity.

2. Describe the phenomena which Maxwell pictured as taking place in the ether in the propagation of electromagnetic waves. Deduce Maxwell's six fundamental equations, viz.

$$\frac{\mu}{c}\frac{\delta\alpha}{\delta t} = \frac{\delta\gamma}{\delta 3} - \frac{\delta 2}{\delta 7} \qquad \frac{\epsilon}{c}\frac{\delta\chi}{\delta t} = \frac{\delta\gamma}{\delta 7} - \frac{\delta\beta}{\delta\xi}$$

$$\frac{\mu}{c}\frac{\delta\beta}{\delta t} = \frac{\delta 2}{\delta\chi} - \frac{\delta\chi}{\delta 3} \qquad \frac{\epsilon}{c}\frac{\delta\gamma}{\delta t} = \frac{\delta\alpha}{\delta 3} - \frac{\delta\gamma}{\delta\chi}$$

$$\frac{\mu}{c}\frac{\delta\gamma}{\delta t} = \frac{\delta\chi}{\delta 7} - \frac{\delta\gamma}{\delta\chi} \qquad \frac{\epsilon}{c}\frac{\delta z}{\delta t} = \frac{\delta\beta}{\delta\chi} - \frac{\delta\alpha}{\delta 7}$$

(The notation of the symbols is the same as usual).

3. Describe and explain the principles of any one form of cymometer. Show how it can be used (if necessary with accessories) to measure (1) the wave length of stationary ascillations on an antenna. (2) the wave length of the electro-magnetic waves radiated from an antenna, (3) the logarithmic decrement of the oscillations.

4. (a) A plant is required to transmit and receive wireless signals over a distance of at least 100 miles, with lengths of waves adjustable from 500 to 1500 metres. Specify the essential features, stating actual magnitudes of the electrical quantities concerned, of the transmitting apparatus which you would recommend.

   (b) Show how to compute approximately, from the actual figures you have taken above, the following important values:

   (1) the power of the prime source of electrical supply;
   (2) the total power taken by the secondary radiating circuit;
   (3) the energy radiated into space as electro-magnetic waves;
   (4) the damping caused by the secondary circuit when radiating.

5. Explain how Resonance may arise between two electric circuits which are closely coupled. Given two circuits with the same natural period, how would you experiment to determine exactly the value of the current in the primary when the secondary is in resonance with it? Indicate and discuss the effect of appreciable damping caused by the secondary circuit.

6. Discuss the results and importance of the following researches of Hertz and others; (1) Reflection of electric waves; (2) Refraction of electric waves; (3) Variation of the refractive index with the wave length.

7. Briefly discuss the following:

   (1) The purpose for the use of a receiving oscillation "jigger" and the proper type of detector to be used with it.
   (2) Outstanding difficulties to be overcome in wireless telephony.
   (3) Effect of sunlight and of athmospheric distubances on the transmission of waves.

FACULTY OF MEDICINE

PHYSIOLOGY

(Second Year)

Thursday, April 15th. Afternoon, 2.00 to 5.00

1. Discuss the mechanism of the circulation of the blood, under the following heads:
   (a) function of the circulation;
   (b) anatomical features;
   (c) regulation of the mechanism of circulation;
   (d) properties of the blood.
2. Describe the secretion of urine, stating the processes with experimental data supporting your views, in:
   (a) a frog;
   (b) a bird;
   (c) the human body.
3. Describe the control of the mechanism of respiration.
4. Describe the exchange of gases in the tissues.
5. Describe in detail the processes through which carbohydrates go when taken as food, and their destination in the body.
6. Discuss the mechanism of the secretion of pancreatic juice.

Department of Pharmacy.

TOXICOLOGY.

Thursday, April 22nd. Afternoon, 2.00 to 5.00

1. Discuss the following poisons from: (a) incidence, (b) signs and symptoms, (c) treatment, (d) identification tests:

   (1) cocaine

   (2) atropine

   (3) zinc sulphate

   (4) strychnine

   (5) phosphorus

   (6) aniline

   (7) aconite

   (8) arsenic

   (9) lead

   (10) opium

FACULTY OF MEDICINE

ZOOLOGY 1

Saturday, April 17th. Morning, 9.00 to 12.00

1. Describe the structure, habitat and physiology of Hydra.
2. Describe in detail the development of the Frog's egg up to the formation of the mesoblast.
3. Define the following: notochord, nematocyst, neurenteric canal, metamerism. Illustrate your answer where possible by sketches and examples.
4. Trace the development of the aortic arch from the simplest to the more complex chordata. Show how this development affects the respiratory system.
5. Compare and contrast an artificial and a natural system of classification. Into what groups are all living organisms divided?